

U. S. Circuit Court. Southern District of
New York.

The American Graphophone Co.)	In Equity.
versus)	on Patent
National Gramophone Co. &)	341,214
Frank Seaman)	No. 7063

MOTION TO WITHDRAW DEFENDANTS' RECORD AND
APPEARANCES
EXHIBITS, CONSENT DECREE OF 3/9/04 (Vol. 4)

Cy/lat 3, 4, 5

RT. tin p3

Parvings 3, 4, 5

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15

E' EX B

E

chall 1

16 17 18 19 23

3 Secondary Laboratory located 54 W 22 ST 1896 - Sp 1898

temporarily McIntyre Bldg

then after move to 4th Ave + 23 ST (United Charity Bldg)

child 1

then 34 W 24th St.

4 Fall 1897 + Sp 1898 established in Brooklyn + Boston
in making records

4 + 5 yrs before Christmas 1897 Secun + Landow stated work of
key as point - due by could be ind. B & Co of rec.

5 Asked dep to cond. making specimens - began immed after
Christ. mss.

Then A. Wangerman of Flushing engaged to assist
matrices made by Rheinbecker & Son, elect noty pens
work cond. until mid March.

6 Laboratory moved to Plaza as of Jan 99 Child applied
to take charge - moved to Jan 99 - duty due to
some spec. recond work - notably Victor Herbert's
Band

7

18 2 mapline returned Dec 1898 cat.

10th 50 W 2nd Bar

Lytle
2
3

Chickster Bell

Mauvo
letter for Tainter 3/13/01
Walter Sanitarium

Dimadio, F. P.

1
2

Olsen

1
2
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4
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9

Johnson
plan, 3

CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York.

In Equity.

The American Graphophone Company,
Complainant.

vs.

National Gramophone Company, and Frank Seaman,
Defendants

Please take notice that on Friday, the sixteenth day of November, A.D., 1900, at ten o'clock in the forenoon, or on the opening of the Court on that day, or as soon thereafter as counsel can be heard, at the Court Rooms of said Court in the Post Office Building in the City of New York, we shall ^{present to the Court} ~~file~~ the Petition, a copy of which is herewith served upon you, and move for an order granting the relief therein prayed, and in support of said motion and of said Petition shall read the affidavits, copies of which are also served upon you herewith.

Berliner Gramophone Company

By *Horace Pettit*
Harold Hayes
of Counsel with Complainant

To
R.N. Dyer, Esq.,
Complainant's Solicitor,

and
Frank Seaman,
Defendant.

November 12, 1900.

CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York.

In Equity.

The American Graphophone Company,
Complainant.

vs.

National Gramophone Company, and Frank Seaman,
Defendants.

The petition of the Berliner Gramophone Company, a corporation of the State of Virginia, and the United States Gramophone Company, a corporation of the State of West Virginia, respectfully shows unto your Honors that the complainant in the above suit filed its said bill against the said defendant, National Gramophone Company and Frank Seaman, to restrain them from using or vending certain devices alleged by the complainant to infringe certain claims of a patent of the said complainant; that an answer was filed on behalf of the said defendants to said bill by Charles E. Mitchell, Esq., ~~Howard W. Hayes, Esq.~~, Gustav Bissing, Esq. and Horace Pettit, Esq. as Solicitors, disputing the validity of said claims and denying infringement, that issue was joined to said answer and proofs were taken thereon, as will more fully appear from the record of said case and from the affidavits hereto attached, to which your petitioners beg leave to refer.

And your petitioners further shows that the said defendant, Frank Seaman, at the time of the filing of the said bill of complaint had a contract with your petitioner, the Berliner Gramophone Company, by which the said Frank Seaman was made the sole selling agent of your petitioner in the United States, and by which your petitioner, the Berliner Gramophone Company was obligated to defend the said Seaman in any suits for infringement brought against him by reason of his selling the said machines furnished by your said petitioner to said Seaman; and that the above suit was brought by the complainant against the said Seaman and the said National Gramophone Company on account of selling said machines (A copy of which contract is hereto annexed, marked "Exhibit A", and made part of this petition); that your petitioner, the Berliner Gramophone Company, with the cooperation of the United States Gramophone Company thereupon undertook and carried on the defence of said suit by its own counsel and its own expense; that on or about the fifth day of May, 1900, the said Seaman entered into an arrangement with the complainant to defraud your Petitioners, and in pursuance of said conspiracy caused a final decree by consent to be entered against the National Gramophone Corporation, the other defendant in said suit, and also to injure and destroy the business of the said Berliner Gramophone Company, by unlawfully and un-

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justly misusing the records of the court by false and misleading advertisements published by the said Frank Seaman through the medium of the National Gramophone Company and its successor, the National Gramophone Corporation, stating directly and by inuendo that the manufacture, sale and use of the gramophone has been enjoined by this Honorable Court and that the gramophone has been adjudged to be an infringement of the patents of the American Graphophone Company; and also that the said Frank Seaman in order further to injure and destroy the gramophone and your petitioners' business has become engaged and is now engaged, through companies which he has organized for the purpose, in making and selling infringements of your petitioners' gramophones and records in direct violation of his contract with your petitioner, the Berliner Gramophone Company, and also is, and has been during the past year, engaged in other conspiracies and plans with the said complainant and the National Gramophone Corporation, the successor of the National Gramophone Company, to injure and destroy the gramophone and your petitioners' business as hereinafter set forth in the affidavits hereto annexed. That on account of said acts of the said Seaman your petitioner, as it lawfully might, cancelled the said contract with the said Seaman, by notice dated the 26th day of *July*, 1900, and since that time no steps have been taken on

behalf of the defendant Frank Seaman in said case; that your petitioners supposed that on account of the alliance between the complainant and said Seaman no further attempt would be made to press the said case until your petitioners' counsel, who appeared for said Seaman, recently received notice from the Counsel for the complainant that the case would be pushed and an attempt made to limit the defendant's time, which was done and defendants' time limited to sixty days from October 19th 1900.

And your petitioners further show that a suit has been brought by the complainant against your petitioner in the United States Circuit Court for the Eastern District of Pennsylvania, in which District your petitioner's principal office and place of business is situated, on the same patent and involving the same issues as the above suit; that said suit in the Eastern District of Pennsylvania has not been pressed by the complainant; that your petitioner, the Berliner Gramophone Company applied on the ninth day of November, 1900, for an order in said last mentioned suit limiting the complainant's time for taking testimony, the hearing of which was postponed owing to the absence of complainant's counsel.

And your petitioners further show that it appears by the testimony already taken in this cause that your petitioners have been conducting the said defence of the

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said Seaman, as above set forth; that your petitioners have expended in preparing said answer and accumulating and presenting said proofs several thousand dollars.

And your petitioners further show that on account of the said conspiracy between the complainant and the said Seaman, and on account of your petitioners having conducted said defence, your petitioners are fearful that some collusive action may take place between the complainant and said Seaman, and some decree or other proceeding made or taken in said cause that will be binding or claimed to be binding upon your petitioners in this and in other Circuit courts of the United States.

And your petitioners further show that it is inequitable for the said Seaman or the said complainant to have any benefit whatever on account of the answer filed, or the proofs accumulated and presented by your petitioners in said cause at such great expense to your petitioners.

Your petitioners therefore pray that the answer so filed and the proofs so presented as aforesaid by your petitioners may be withdrawn from the case, and that your petitioners' counsel who have appeared for said defendant Seaman may be allowed to withdraw such appearances, and that your petitioners may have such further and other relief as to your Honors shall seem meet and shall be agreeable to equity and good conscience.

And your petitioners will ever pray &c.

Berlin Gramophone Company
by H. S. Parnin
President

Horace Pettit
Howard Hays
Solicitors of counsel
with Berlin Gramophone
Co.

CIRCUIT COURT OF THE UNITED STATES

For the Southern District of New York.

In Equity.

The American Graphophone Company
Complainant.

vs.

National Gramophone Company, and Frank Seaman
Defendants

Sur Motion to withdraw Defendants' Record and
Appearances from Case.

AFFIDAVIT OF THOMAS S. PARVIN

Commonwealth of Pennsylvania,)
)ss.
City and county of Philadelphia.)

Thomas S. Parvin, being duly sworn according to law, deposes and says as follows:-

This suit was brought to restrain the sale of gramophones which were alleged to be infringements of Letters Patent of the United States No. 341,214 341,288 and 375,579 for Improvements relative to Graphophones said to be owned by the complainant company .

I am the president of the Berliner Gramophone Company, and have been since its incorporation and organization in October, 1895. This company was organized for the purpose of manufacturing and selling gramophones under the patents for the same issued to Emile Berliner, and controlled by the said Berliner Gramophone Company, by contract and agreements with the United States Company, the owner of the said patents. By agreement dated the tenth day of October, 1896, a copy of which is hereto annexed, marked "Exhibit A", the Berliner Gramophone Company appointed Frank Seaman, one of the defendants in this case, its sole and exclusive selling agent and licensee to sell the Berliner Gramophone manufactured by the said Berliner Company throughout the United States, with the exception of the District of Columbia. Among other things it was provided in the said agreement that the said Frank Seaman should use his best efforts to promote the gramophone business within the United States, and that he should not manufacture, buy, sell or use gramophones or gramophone goods, or any parts thereof, or any other talking machines, or parts thereof except such as he buys from the Berliner Gramophone Company. The Berliner Gramophone Company agreed in Article 6 of the said agreement to defend, at its own cost and expense, whenever requested by the said Seaman all actions and suits involving the validity of any of the patents of the said Berliner mentioned in the said agreement, or of

any other patents which may be issued for improvements in the said inventions and may become subject of this agreement.

Since the date of the said agreement with the said Seaman the Berliner Company has caused to be manufactured and has sold and delivered to the said Seaman large numbers of gramophones and gramophone records .

Immediately after the making of the said contract, Frank Seaman organized in October, 1896, under the laws of the State of New York, the National Gramophone Company, one of the defendants named herein, for the purpose of taking over the contract, but the Berliner gramophone Company never gave its approval, which was necessary under the agreement, and the National Gramophone Company never took over the contract, or had any direct relations with the Berliner Gramophone Company. Frank Seaman, however, continued the said company, using it as the main selling medium through which he sold all the gramophones and gramophone records ordered of the Berliner Company; he controlled all the stock of the National Gramophone Company at that time, which had its offices in the same building with himself, 874 Broadway, New York, and he, Frank Seaman, from that time continued to control and direct the management and business of the said National Gramophone Company. In March, 1899, Frank Seaman organized the National Gramophone Corporation, which took over the business of the National Gramophone Company at a greatly increased valuation, and in June, 1899, the National Gramo-

phone company was dissolved. The National Gramophone Corporation occupied quarters ~~with~~ in the same building with Frank Seaman,- the same quarters which the National Gramophone Company had occupied, #874 Broadway, New York City, and which it continues to occupy .

When the Bill in Equity in this case was filed against the National Gramophone company and Frank Seaman in October, 1898, the said Seaman promptly notified me , as President of the Berliner Gramophone Company of the said suit, requesting that the Berliner company defend it under the said agreement of October, 1896, I forthwith employed as counsel for the purposes of defending the said suit Hon. Charles E. Mitchell, Howard W. Hayes, Esq.

✓ Messrs. Lyons & Bissing and Horace Pettit, Esq., all of ^{whom} immediately took steps looking to the defense . A motion for Preliminary Injunction was made pursuant to notice of November 11, 1898, and resisted . On December 10, 1898, ✓ the motion was granted though ^{was} opportunities given to the defendants to appeal before the injunction should go into effect , which was done, and on March 1, 1899, the Circuit Court of Appeals, in an opinion by Judge Shipman, dismissed the injunction, reversing the Court below .

Frank Seaman was consulted and took part in some of the conferences , and when it came to enter the appearances of counsel of record he insisted that Waldo G. Morse, Esq., of New York City, New York, whom he brought into the case, and who was present at some of the conferences with counsel engaged by the Berliner Company, should appear

on the record as attorney for the National Gramophone Company ,and specially requested that the counsel hereinbefore mentioned, selected by the Berliner Company to defend the suit, should only appear on the record for him Frank Seaman, and not for the National Gramophone company, which request was granted .

On May 5, 1900, while defendants' testimony was being taken, the said Waldo G. Morse, with the knowledge of the said Frank Seaman, and in connivance with him, as solicitor and of counsel for the defendant, the National Gramophone Company, consented in writing to the entry and filing of a decree against the said National Gramophone Company in this cause, assenting to the validity of all the Letters Patent in suit, to the title of the complainant and to the infringement by the said National Gramophone Company in selling and dealing in gramophones, and consenting to a settlement on the amount agreed on of all claims for damages and profits on account of its admitted infringement. A copy of said Consent Decree is hereto attached, marked "Exhibit B". The said consent Decree was signed by the said Waldo G. Morse without the knowledge or consent of any of the other counsel engaged for the defendants and of record in this suit, and without the knowledge or consent of the Berliner Gramophone Company .

This deponent is informed and believes that the said Frank Seaman was the instigator of the said Consent Decree, and that through his control of the National Gramo-

phone Company, and the National Gramophone corporation, this decree was caused to be entered . Frank Seaman's actions, especially since this suit has been brought , as herein set forth, show me clearly his object in insisting that Waldo G. Morse, his private and confidential attorney, should alone appear on the record for the said National Gramophone Company, so that he, Frank Seaman, should be able at any time without conference with, or the consent of, the Berliner Company, or counsel employed by it, to enter a decree against the Berliner Gramophone, notwithstanding the fact that the Berliner Gramophone Company has been expending large sums of money in order that the full and complete defense which exists to the unjust claim of the American Graphophone Company ~~taxes~~ should be presented to the Court .

The said Frank Seaman, I have recently conclusively ascertained, has been persistently for some time past working against the interests of the gramophone , and has entered into collusion with the complainant in this case to use this case, as far as he is able, as a means of preventing the Berliner Gramophone Company from manufacturing or selling gramophones, and has entered into an arrangement and agreement through his companies, the National Gramophone Corporation, and the Universal Talking Machine company, both of which he controls, with the complainant in this case, so that the said Frank Seaman and the American Graphophone Company may be able, ~~with their~~

if their plans work out, to suppress the gramophone, commencing on these lines by entering a consent decree through Waldo G. Morse as of counsel for the National Gramophone Company. The National Gramophone Corporation, the successor of the National Gramophone company, and The Universal Talking Machine Company, both controlled by Seaman, have, as I am informed and believe, ^{since} taken a license from the American Graphophone Company, the consent decree, as I am informed and believe, being a part of the consideration for the same.

Frank Seaman's connection with, and control of, the National Gramophone company and its successor, the National Gramophone corporation, is clear, as this deponent believes, beyond a doubt.

Shortly after the contract of October 10, 1896, was executed Frank Seaman began to lay plans and schemes to evade the contract and to place himself in a position to manufacture and sell gramophones in infringement of the Berliner patents, so that he would be relieved from paying the royalty or sum provided in the said contract. With this object in view he organized and retained the control of the National Gramophone Company, and subsequently of the National Gramophone corporation, and in advertising the goods he systematically suppressed or avoided the use of the word "Berliner", so that the gramophones should not become to be known by a name which his infringing companies, when the time came, could not use,

His company, The Universal Talking Machine Company, organized under the advice of Waldo G. Morse, Esq., a number of months ago, commenced the manufacture and sale of a gramophone which was termed the "Zonophone", and which was largely, and still is largely, advertised and sold by the National Gramophone corporation, the successors of the National Gramophone company. They also commenced the manufacture and sale of gramophone records for the Zonophone, which they are now continuing and largely selling. The machine is an infringement of the gramophone, and differs ~~only~~ from it only in slight modifications of construction. It was sold also with the records and sound boxes of the Berliner Gramophone Company.

General Manager

Mr. O. D. LaDow is secretary and ~~xxxxxxx~~ of the National Gramophone Corporation, and at the time this suit was brought was secretary and manager of the National Gramophone Company. In May, 1897, Mr. Seaman told me, while at Broadwater, Virginia, about a man he expected to employ, and shortly afterwards, when I was in New York, Seaman introduced me to O. D. LaDow as the man of whom he spoke while we were at Broadwater. LaDow was established in an office adjoining Seaman's office, and separated from it by a low partition, through which there was a communicating door. I have frequently been in these offices, and have seen LaDow open Seaman's safe in Seaman's private office, both when Seaman was present and when he was absent. In Gramophone matters, LaDow habitually act-

ed for Seaman . He ordered goods from us as Seaman's representative and Seaman paid for them. LaDow frequently answered letters addressed to Seaman, and Seaman never disavowed them. LaDow since 1897 in all business matters which I have had with Seaman, whenever he has appeared, has acted as Seaman's representative and confidential man ; when Seaman organized the National Gramophone Company his man, LaDow, was made secretary and manager, and when the National Gramophone Corporation was organized by Seaman to succeed the National Gramophone Company LaDow was made secretary and general manager, nor did his acceptance of this position change in any way his close relation to Frank Seaman. When Seaman organized the Universal Talking Machine Company, or arranged for its organization, O.D. LaDow was made President .

During frequent visits to Seaman's office in New York City, adjoining which was the office of the National Gramophone Company, I have noticed that Miss Francis Crouch opened both the mail of Frank Seaman and of the National Gramophone Company . Frank Seaman was for a long period of time treasurer of the National Gramophone Company, and subsequently of the National Gramophone Corporation, and his name so appeared upon their printed matter .

The said Waldo G. Morse is counsel for the National Gramophone Company, the National Gramophone Corporation, and is counsel for Frank Seaman in a suit brought in the United States Circuit Court for the Western District of Virginia against the Berliner Gramophone Company, and is counsel for Frank Seaman in a suit brought by him against Eldridge R. Johnson in the United States Circuit Court for the Eastern District of Pennsylvania, and is counsel for the National Gramophone Corporation in a suit brought in the United States Circuit Court for the Southern District of New York by the Berliner Gramophone Company, et al. against the National Gramophone Corporation. In the suit against the Berliner Company in Virginia he has made an affidavit in behalf of Frank Seaman, and is on the injunction bond in the ~~xxxxxx~~ said suit. In the case against Johnson in the Eastern District of Pennsylvania he has also made an affidavit in behalf of the said Seaman. I am also informed and believe that he was elected a director of the National Gramophone Corporation at its last annual meeting.

On May 26, 1900, the Berliner Gramophone Company instituted three equity suits in the Circuit Court of the United States for the Eastern District of Pennsylvania against the National Gramophone Corporation to restrain it from infringing the patents of the Berliner Gramophone Company. May 26th. was on Saturday, and the following Monday, May 28th., Frank Seaman resigned as treasurer of

the National Gramophone Corporation, and so notified the Berliner Gramophone Company .

In confirmation of my statement ,hereinbefore made, as to the collusion of the said Frank Seaman, through his companies, the National Gramophone Corporation and The Universal Talking Machine Company, with the complainant in this case, the American Graphophone Company, and its sub-company, the Columbia Phonograph Company, I refer to the advertisements of the said National Gramophone Corporation, such for instance, as were contained in Scribner's Magazine, ~~advertiser~~ for July ,1900, and Leslie's Weekly of August 4, 1900, copies of which are hereto annexed, marked "Exhibits C" and "Exhibit D", respectively.

This deponent further states that the said Seaman has been for many months past, and is now , through the medium of advertisements, in the public prints, magazines, circulars, etc. by the aid of the National Gramophone Corporation been warning the public and dealers generally not to purchase gramophones or gramophone goods , stating that ^{they are} ~~it an~~ infringements of patents owned or controlled by the National Gramophone corporation, and by misrepresentations and mistatements endeavoring to lead the public to believe that the gramophone is an infringement of patents owned or controlled by the said company, and endeavoring to mislead the public into the belief that the Circuit courts of the United States have adjudged the gramophone to be an infringement of some patent owned or controlled by the allied companies mention-

ed in the said circulars and notices; and leading the public to believe that the gramophone has been abandoned, and stating that the Zonophone is the only legitimate disc (flat record) talking machine. As an illustration of this character of advertisement I produce an advertisement of the said National Gramophone Corporation contained in the Scientific American of the issue of October 6, 1900, copy of which is hereto annexed, and marked "Exhibit E".

This deponent believes and avers that the intent of the said Frank Seaman is clearly to use this case, as far as he is able, to assist his purposes in defeating the gramophone, by arranging a consent decree against one of the defendants, the National Gramophone Company, through his private attorney, Waldo G. Morse, who is the attorney for the National Gramophone Company (Mr. Seaman refusing to allow any body else to appear on the record for that company) so as to further his plans in connection with the complainant, the American Graphophone Company, while at the same time to have it appear that he, Frank Seaman was defending his side of the suit as far as he was concerned as a nominal defendant, knowing and believing also at the same time that the connection of the Berliner Gramophone Company with his defence of the case would probably prejudice it by leading the public to believe that a decree had been entered against the defendant in a suit ~~xxxx~~ in which it was the real defendant or was defending him; and further to prejudice the Berliner company by ^{leading} ~~believing~~ the public to believe

that notwithstanding the strained relations and suit between the said Seaman and the said Berliner Company that the said Berliner Company was defending him .

This deponent further shows that that in view of the utter disregard of the said Seaman of his part of the performance of the contract of October 10, 1896, and in view of the many breaches committed by him of said contract the Berliner Gramophone Company by resolution of its Board of directors declared all rights of the said Seaman under the said contract of October 10, 1896, to be absolutely ended, and that notice of the action of the said Board was personally given to the said Seaman on July 26, 1900. This deponent further states that by reason of the said violations of the said contract on the part of the said Seaman, the Berliner Gramophone Company did on the twenty third day of October, 1900, enter suit, through its attorneys, Messrs Carter ⁺ Ledyard in the Circuit Court of the United States for the Southern District of New York, against the said Frank Seaman for the recovery of two hundred thousand dollars damages . This deponent states that the Berliner Company may be further prejudiced should it continue the defence of this suit in its said suit for damages .

This deponent also states that no testimony has been taken on behalf of the defendant in this case since the said Frank Seaman caused the said consent decree of May 5, 1900, to be entered against the National Gramophone

Company. That the only meeting which has been held since that time for taking testimony was a short meeting of July 25, 1900, arranged at the solicitation of counsel for complainant for the purposes of a brief cross-examination of defendants' expert .

This deponent further states that the whole intent and scheme of the said Frank Seaman to injure and destroy the gramophone was not known to me at the time that arrangements were made in November, 1898, for the defence of this suit, and that ~~that~~ I have only recently had the full information which has developed regarding the plans and schemes of the said Seaman . I am firmly of the belief that the said Seaman in November, 1898, ~~was~~ was making arrangements to injure, and if possible, destroy the Berliner Gramophone, and has since that time been constantly working and scheming to this end notwithstanding the fact that the Berliner Gramophone Company in good faith, while defending the gramophone, was defending his interests as a defendant in this suit in accordance with the contract of October 10, 1896, and that in view of the perfidy and the false position occupied by the said Seaman throughout all this period of time in which the Berliner Gramophone Company was spending large sums of money for counsel fees and experts, as well as in investigating the prior art, the counsel retained by it should be allowed to withdraw the answer filed by them and all the testimony taken by them in behalf of the said Frank Seaman, and to withdraw from the case . This deponent

believes that to merely allow the counsel of record for Frank Seaman to withdraw and not to be able to take with them the defence, Answer and proofs would greatly prejudice and injure the gramophone, and the Berliner Gramophone company, who are acting in good faith throughout all the proceedings for the benefit of the said Frank Seaman . That if the counsel of record for Frank Seaman merely withdrew I know from the surrounding circumstances a full defence would not be presented in the subsequent proceedings of the case, so long as the said Frank Seaman remains a defendant, and that a decree in this case against the defendant would be a destructive blow to the gramophone which has a full and complete defence, only the expert testimony having been introduced and no testimony, as yet, as to the prior art .

The American Graphophone Company, the complainant, on December 15, 1898, brought a suit on the same patents as involved in this cause against the Berliner Gramophone Company, Thomas S. Parvin, individually and as president of the said Berliner Gramophone Company, and E. R. Johnson , in the U. S. Circuit Court for the Eastern District of Pennsylvania, of October Sessions, 1898, No. 34 . Appearance was duly entered February 4, 1899 by counsel for defendants, and on March 6th. and 9th the Answers of the defendants respectively were filed; on March 23, 1899, the replication was filed ^{and} in ^{was} the case ^{was} at issue.

This deponent further states that notwithstanding the fact that this is the case which should be fully

and promptly prosecuted by the complainant it has done nothing whatsoever since the filing of replication, but by reason of the surrounding circumstances has apparently seen fit to prosecute the suit against the National Gramophone Company, and Frank Seaman.

This deponent believes and avers that this case against the Berliner Gramophone Company in the Eastern District of Pennsylvania should be prosecuted, and that the complainant should be made to proceed in this case, in which the defendants are in no ways compromised by alliances and arrangements with other competing concerns; and that the suit against the manufacturer and not the suit against the seller should be first prosecuted.

This deponent further shows that in order to compel the complainant to proceed with the suit against the Berliner Gramophone Company, et al. motion has been made on the 3rd day of November, 1900, in the U.S. Circuit Court for the Eastern District of Pennsylvania in the said case to compel the complainant to complete its testimony in its prima facie case promptly, or in default the Bill to be dismissed. That the said motion has been noticed for hearing for the ninth day of November, 1900.

This deponent further states that in addition to the circulars and advertisements of the National Gramophone Corporation, the successor of the National Gramophone Company, hereinbefore referred to, a circular letter has recently been issued and circulated among the trade, printed on the letter heading of the National

Gramophone Corporation, dated October 26, 1900, signed "National Gramophone Corporation, by O.D. LaDow, Secretary," which said letters is ready in court to be produced and a copy of which is hereto annexed, marked "Exhibit F"

The said O.D. LaDow, who was formerly the Manager of the National Gramophone Company, during the greater time of its existence, and who is now the Secretary and General Manager of the National Gramophone Corporation, states in the said circular of Oct. 26, 1900, among other things, that "the National Gram-o-phone Company succeeded to the Gram-o-phone business", and the Berliner Gram-o-phone Company stepped out", the said LaDow practically thereby admitting that the National Gramophone Company and Frank Seaman were one and the same ~~this~~ party, as any rights which may have been acquired by Frank Seaman in and to the gramophone were acquired as licensee under the agreement of October 10, 1896, from the Berliner Gramophone Company, and the only gramophone which the National Gramophone Company ever sold or dealt in were Berliner Gramophones purchased ^{by Seaman} from the Berliner Gramophone Company and shipped by it direct to the National Gramophone Company under the orders of Frank Seaman; Mr. LaDow, however, who was at the time Mr. Seaman's confidential man, and the Manager of the National Gramophone Company, now as the Secretary of the National Gramophone Corporation in this circular of Oct. 26, 1900, apparently treats and regards the National Gramophone company and Mr. Frank

Seaman as one and the same party ,and practically admits that they were one and the same when he states in the said circular that the National Gramophone Company succeeded to the business of the Berliner Gramophone Company ,or to use Mr.LaDow's language "the National Gramophone Company succeeded to the gramophone business, and the Berliner Gramophone Company stepped out".

Among the names of the officers of the National Gramophone Corporation printed on the heading of this circular letter of Oct.26,1900,was that of "Frank Seaman,Treasurer " with a deep black line printed over the name, but accidentally so placed as not to entirely obscure the name upon careful examination.

As hereinbefore stated and as shown by the advertisements referred to, and hereto annexed, including the said circular letter of Oct.26,1900, the American Graphophone company, the complainant in this case, has, as I believe and aver, been conspiring and conniving with the said National Gramophone company and the National Gramophone Corporation, and with Frank Seaman, the defendants in this case, to damage and injure the business of the Berliner Gramophone Company in its endeavor to drive it out of business, and has been wilfully and maliciously conniving and conspiring with the said defendants herein to injure and destroy the Berliner Gramophone Company's business by issuing and circulating and publishing misleading and malicious statements to the customers and agents of the Berliner Gramophone Company for the

purpose of diverting the Berliner Company's trade unjustly to themselves, and by attempting, through the medium of said publications to lead the public to believe that the gramophone has been adjudged by this court to be an infringement of the ~~Berliner~~ American Graphophone Company's patents, and of patents owned or controlled by the defendants herein in conjunction with the American Graphophone Company, the complainant herein. That the said National Gramophone Corporation, which is controlled by the said Seaman, is, in conjunction with the complainant herein, issuing unfair and misleading notices and warnings against the gramophone, such as, for instance, the advertisement in the Saturday Evening Post of Oct. 20, 1900, a copy of which is hereto annexed, and marked "Exhibit G", and the advertisement in the Century - November Issue - a copy of which is hereto annexed, and marked "Exhibit H". Also in a postal card notice which has been circulated through the United States mails threatening and warning purchasers of the gramophone to the purport that the gramophone has been enjoined by the United States Circuit Court, a copy of which said postal is hereto annexed, Marked "Exhibit I".

This deponent also states that the American Graphophone Company, the complainant herein, is issuing circulars and advertisements and sending circulars through the United States mail leading the public to believe that the gramophone has been adjudged upon hearing to be an infringement of the patents of the American Graph-

ophone Company, and in a recent circular to "The Talking Machine Trade" signed "American Graphophone Company by E.D. Easton, President", dated Oct. 17, 1900, it states that the gramophone "has been enjoined by the circuit Court of New York as an infringement", which this deponent believes and states is a palpable attempt to mislead the public as to the true condition of the record of this Honorable Court in this case. The said circular also, notwithstanding the fact that there has been no adjudication, threatens all persons against the use of the gramophone.

This deponent believes that the complainant in this case, in view of its actions in the matter, deserves no consideration and indulgence by this Honorable Court in the matter of this motion.

A copy of the circular letter of the American Graphophone Company of Oct. 17, 1900, above referred to, is hereto annexed, marked "Exhibit J". Also circular letter dated May 18, 1900, after the consent decree of May 5, 1900, issued and signed by the National Gramophone Corporation; which is marked "Exhibit K"; also circular letter dated June 27, 1900, on the letter heads of the Law Office of Philip Mauro, issued by and signed with the names of "Philip Mauro, Counsel for American Graphophone Company and Columbia Phonograph Co. and Waldo G. Morse, Counsel for the National Gramophone Corporation", which is marked "Exhibit L". Exhibit J of the Graphophone Company and Exhibit F of the National Gramophone Corporation were sent together²⁰ in the same envelope through the mails to the dealers and users of talking machines.

This deponent further states that there were three subscribers to the Certificate of Incorporation of the National Gramophone Company, which was dated October 19, 1896, viz., Frank Seaman, 498 shares, Harry Bentz, 1 share, and William B. Owen, 1 share, and that at the time the dissolution proceedings of the said National Gramophone Company was signed May 19, 1899, the said Frank Seaman by himself, and as attorney for Lillie H. Seaman, his wife, owned 5,153 shares of stock, out of an assenting total of 6023 shares, about 100 of the balance being owned personally, or by attorney, by O. D. LaDow.

Attached to the affidavits accompanying this Motion I have caused to be added a certified copy of an affidavit of William Barry Owen, the original of which was filed in the case of Frank Seaman vs. the Berliner Gramophone Company, in the U. S. Circuit Court for the Western District of Virginia, which copy is duly certified to by A. K. Fletcher, Esq., Clerk of the said Court. This certified copy is herewith produced for the reason that the said Owen is now, at the present time, in London England, and it is impossible to get from him an affidavit specially made for the purposes of this case in time for the hearing of this motion. The said certified copy of the affidavit contains matter important to the issues herein involved.

I would further state, in conclusion, that it appears upon the record of this case in the testimony of Joseph Lyons, a witness called on behalf of defendants, in the cross examination of this witness by Mr. Mauro, counsel for complainant, (XQ 23 and XQ24) that the Berliner Gramophone Company, and its licensor, the United States Gramophone Company, have been conducting the defence of this suit, and are the real defendants herein.

Mr. Mauro on his cross-examination asked the witness, among other things, as follows:-

"XQ23. Do you know ^{of} the existence of a company called the United States Gramophone Company and of another Company called the Berliner Gramophone Company?

"A. Yes, I know ^{of} the existence of these Companies and I was at one time an officer ~~of~~ the United States Gramophone Company. I was an officer of that company by courtesy.

"XQ24. These companies are conducting the defence of the present suit and are the real defendants herein, are they not ?

(Objection noted)

"A. Yes, I understand these Companies are defending this suit."

I would state that the fact is as the record shows, as above quoted, that the Berliner Gramophone Company, in conjunction with the United States Gramophone Company, has been conducting the defence of this suit from the start, and paying out large sums of money therefor, and are the real defendants, but that it is impossible under the state of facts as they now exist as shown in this affidavit, and the accompanying affidavits, by the reason of the acts of the nominal defendants in this case and

by reason of the relations as they now exist between the nominal defendants in this case and the real defendants, and by reason of the various suits which are now pending between the said nominal defendants and the said Berliner Gramophone Company and the United States Gramophone Company, to continue the said defence, or to leave in the case the defendants' record, without greatly prejudicing the Petitioner herein and its rights in the premises, without greatly damaging and injuring the interests of the gramophone. That the Petitioners cannot properly and fully defend any patent case in which the gramophone is alleged to infringe the patents of the American Graphophone Company which has the name of Frank Seaman or the National Gramophone Company, or Corporation, as defendants. The acts of these nominal defendants herein set forth and complained of have so handicapped and hampered the presentation of a full and complete defence, and have so tainted the case against the interests of the defendants by consent decree, and by connivance and collusion that it will be impossible to have the defence of this case freed therefrom. The proper suit, therefore, involving the question of the patents in suit and the alleged infringement is the suit which the complainant company has brought against the real defendants, the Berliner Gramophone company, in the Eastern District of Pennsylvania, which case is entirely free from any connection with the said Frank Seaman and the National

Gramophone company, or Corporation

Thomas S. Parvin

*Sworn and subscribed to
before me this Tenth day of No-
vember A.D. 1900.
Charles H. Speckman
Notary Public*

"Exhibit A"

(Copy of Contract of Oct. 10th, 1896.)

Exhibit "A"

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Agreement of Oct. 10, 1896.

THIS AGREEMENT, Made the Tenth day of October, A. D. one thousand eight hundred and ninety-six (1896), between the *Berliner Gramophone Company*, a corporation of the State of Virginia (hereinafter called "*Licensor*"), party of the first part, and *Frank Seaman*, of New York City (hereinafter called the "*Licensee*"), party of the second part, *Witnesseth That*:

WHEREAS, The Licensor exclusively controls, in the United States of America, the inventions of Emile Berliner, Esq., made and to be made, relating to the Gramophone and the Letters Patent of the United States issued and to be issued therefor (including the following patents, viz.: No. 372,786, dated 8 November, 1887, for a Gramophone; No. 382,790, dated 15 May, 1888, for a Process of Producing Records of Sound; No. 534,543, dated 19 February, 1895, for a Gramophone; and No. 548,623, dated 29 October, 1895, for an Improvement in Sound Records and Methods of Making Same); and the Licensee desires to buy, sell and deal in gramophones and gramophone goods (except recording apparatus) as hereinafter set forth;

NOW, THEREFORE, IN CONSIDERATION as well of the sum of One Dollar paid by the Licensee to the Licensor, the receipt of which is hereby acknowledged, as of the sums of money hereafter to be paid as hereinafter described, and of the covenants on the part of the Licensee hereinafter contained, and subject to the terms of all the covenants hereinafter contained, the Licensor hereby grants to the Licensee the exclusive license to buy, sell and deal in, throughout the United States of America (except in the District of Columbia), gramophones and gramophone goods embodying the said inventions, and all improvements therein that may come into the Licensor's control (except recording apparatus), for a period of fifteen years from the date of this agreement;

AND, FOR THE CONSIDERATIONS AFORESAID, The Licensor covenants to and with the Licensee that:

1. As long as, during the period aforesaid, the Licensee punctually performs his covenants hereinafter contained, the Licensor shall sell exclusively to the Licensee the gramo-

phones and gramophone goods aforesaid, in the territory hereinbefore allotted to the Licensee, at the prices and on the terms hereinafter stated; and shall not sell or deliver any of the gramophones and gramophone goods aforesaid in the territory aforesaid to any other person or corporation, except to officers, directors and stockholders of the Licensor—and in that case only in reasonable quantities, for their own use and to be given away by them, but not to be sold for profit;

2. The gramophones and gramophone goods so to be sold by the Licensor to the Licensee shall conform to samples heretofore submitted by the Licensor and approved by the Licensee and such other samples as the Licensee may hereafter approve, or may himself make and give to the Licensor, with working drawings, patterns, cost-sheets and all other information, necessary for the manufacture of gramophones and gramophone goods, according to the said samples—*Provided*, That the Licensee shall make no sample discs or records;

3. As long as, during the period aforesaid, the Licensee punctually performs his covenants hereinafter contained, the Licensor shall fill, with reasonable promptness and despatch, all orders of the Licensee for gramophones and gramophone goods by delivering, f. o. b. cars or other means of transportation, designated by the Licensee, at the place of manufacture, gramophones and gramophone goods, as ordered, in good working and marketable condition according to samples—*Provided*, That the Licensor shall be allowed sufficient time to manufacture the said gramophones and gramophone goods, after the receipt of orders, and that, if, for any unavoidable cause, such as fire, flood, strikes of workmen, litigation or failure of facilities for transportation, delay occurs in filling the said orders, the delay shall not be deemed a breach of covenant, but the Licensee shall receive on the time limits of his minimum guaranty of purchases, as hereinafter set forth, an extension for a period equal to the period of the said delay—*And provided further* That, as long as, by reason of any litigation growing out of a contract heretofore made between the said Berliner Gramophone Company and Messrs. Tate and Jones, the Licensor is actually prevented from selling, to the Licensee and the Licensee is actually prevented from dealing in, gramophones and gramophone goods, within the New England States, there shall be a reduction of 12 per cent. in the Licensee's minimum guaranty of advertising, and in the Licensee's minimum guaranty of purchases, as hereinafter set

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forth; and the Licensor shall be permitted to sell under the contract with Tate and Jones.—*And provided further* That the Licensor shall be permitted to sell gramophones and gramophone goods, under a contract heretofore made between the said Berliner Gramophone Company and Edward J. Nellis, as long as the said contract shall be in force, but the said Licensee shall cause the said contract to be cancelled without unnecessary delay;

4. If the Licensor makes default and fails to fill, with reasonable promptness and despatch, as hereinbefore covenanted, any of the orders of the Licensee, the Licensee may, after notification in writing of his intention to the Licensor, supply, in the manner and on the terms hereinafter stated in Section 8 of this agreement, the gramophones, gramophone goods and parts for the repair thereof, necessary to fill the orders so defaulted by the Licensor;

5. The Licensor shall, for the prices and on the terms hereinafter stated, furnish to the Licensee parts for the repair of gramophones and gramophone goods, in so far as the Licensor can furnish the said parts without interfering with its filling the regular orders of the Licensee for gramophones and gramophone goods—*Provided*, That, if required by the Licensor, the parts to be replaced by the parts thus furnished, shall be surrendered to the Licensor, or their loss shall be satisfactorily accounted for;

6. The Licensor shall defend at its own cost and expense, whenever requested by the Licensee, all actions and suits involving the validity of any of the patents hereinbefore mentioned, or of any other patents which may be issued for improvements in the said inventions, and may become subject to this agreement;

7. The Licensor shall forward immediately to the Licensee all mail of whatever kind or nature which has to do with the selling of goods, within the territory aforesaid during the life of this agreement—except in so far as the said mail should, under contracts with the United States Gramophone Company, be forwarded to that Company;

8. The Licensee shall have the privilege of supplying by contract to the Licensor gramophones and gramophone goods and parts for the repair thereof to fill the orders of the Licensee—*Provided* That the said gramophones, gramophone

goods and parts for the repair thereof shall be equal in quality to those supplied by the Licensor—*And provided also* That the Licensee shall furnish the said gramophones, gramophone goods and parts for the repair thereof, at, at least, 5 per cent. less than the cost at which the Licensor can manufacture them or procure them elsewhere, and that any loss or delay resulting from their not proving satisfactory or not being delivered on time, shall be deemed to be the fault of the Licensee. But the manufacture of gramophones, gramophone goods and parts for the repair thereof, if undertaken by the Licensee,

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shall be subject to the restrictions of all contracts with the United States Gramophone Company and Emile Berliner, and under no circumstances shall the Licensee manufacture discs or records;

9. The Licensee may cause to be incorporated and organized, under the laws of the State of New York or of any other State, a corporation or corporations with such powers and capital as the Licensor may in writing approve, and after such approval the Licensee may assign to the said corporation or corporations all the rights hereby granted by the Licensor, *Provided* That the said corporation or corporations shall assume and undertake the performance of the covenants to be performed by the Licensee hereunder—whereupon all liability on the part of the Licensee for the future performance of the said covenants shall cease, but the Licensee shall not be relieved from his liability for previous breaches of the said covenants;

AND, IN CONSIDERATION of the license and covenants by the Licensor hereinbefore contained, the Licensee does hereby covenant to and with the Licensor as follows, viz.:

10. For all gramophones, gramophone goods and parts for the repair thereof ordered by the Licensee, the Licensee shall, within ten days after their delivery, f. o. b. cars or other means of transportation, designated by the Licensee, at the place of their manufacture, pay in full without discount, and shall in any event take and pay for all goods ordered; and if at any time, or from time to time, the Licensor shall in writing request payment on delivery, the Licensee shall pay the Licensor according to the Licensor's request;

11. As a minimum guarantee of purchases, the Licensee shall order and purchase from the Licensor, according to

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samples already approved by the Licensee and such as may hereafter be established as hereinbefore covenanted, and at prices to be fixed as hereinafter mutually covenanted, gramophones and gramophone goods amounting at manufacturing cost to the aggregate amounts following (which amounts in every instance are understood to mean not the prices but merely the manufacturing cost of the said gramophones and gramophone goods, exclusive of the 40 per cent. margin hereinafter mentioned and all royalty), viz.: during the month of September, 1896, \$1,333.34; during the month of October, 1896, \$2,666.67; during the month of November, 1896, \$5,333.34; during the month of December, 1896, \$8,000; during the month of January, 1897, \$2,766.67; during each and every calendar month in the year 1897 after the month of January, \$6,666.67; during the month of January, 1898, \$6,666.67, and thereafter, until the expiration of the period of fifteen years first hereinbefore mentioned, during each and every calendar month, \$10,000—*Provided* That any excess of purchases in any one month over and above the minimum guaranty fixed in this section for that month shall be applied thereafter, at the option of the Licensee, toward the fulfillment of the minimum guaranty for any subsequent month during the year then current, dating the year from the first day of February last precedent—*And provided further* That parts ordered by the Licensee for the repair of gramophones and gramophone goods and on which the Licensor is not required to pay royalty shall not be counted toward the fulfillment of the Licensee's minimum guaranty;

12. The Licensee shall use his best efforts to promote the gramophone business in the United States and shall advertise gramophones and gramophone goods prominently and freely as "Berliner" gramophones and "Berliner" gramophone goods; and shall expend immediately, and, in any event, not later than 15th March, 1897, for that purpose, the sum of at least \$10,000 at lowest current publishers' prices to advertisers.

13. The Licensee shall not manufacture, buy, sell or use gramophones or gramophone goods, or any parts thereof, or other talking machine or parts thereof except such as he buys from the Licensor;

14. The Licensee shall see that all gramophones and gramophone goods sold by him bear serial numbers, when the Licensor affixes serial numbers; and shall keep a record of all

gramophones and gramophone goods sold by him, showing distinctly such serial number and the purchaser of every article sold; and shall at all times exhibit the said record to the Licensor when requested;

15. The Licensee, hereby admitting and conceding the validity of the Letters Patent hereinbefore mentioned, shall not dispute or contest them, and shall not make use of any other name than that of Emile Berliner, in connection with gramophones and gramophone goods; and shall not detach or deface any patent marks or other marks or labels placed by the Licensor upon its gramophones, gramophone goods and publications, and shall not add to them, other marks or labels, without the consent in writing of the Licensor;

16. For the breach of any covenant, herein contained, on the part of the Licensee, the Licensor may, at its option, give notice in writing to the Licensee, pointing out the cause of complaint; and if, within thirty days after the delivery of the said notice to the Licensee, the Licensee shall not remove the cause of complaint, and fully perform the covenant so broken, then the Licensor may, by second notice in writing to the Licensee, revoke the license hereby given, withdraw from all its covenants, and annul all the Licensee's rights hereunder; and in that case all liability of the Licensee, on his covenants in this agreement shall cease, except that he shall remain bound to take and pay for, in accordance with the terms hereof, all gramophones, gramophone goods and parts for the repair of gramophones for which he has at the time actually given orders. If the breach of covenant consists in the failure to pay money, the first notice may, after ten days have expired, at the option of the Licensor, work the revocation, withdrawal and annulment hereinbefore described, without any further days of grace or second notice. The remedy given in this section is exclusive so far as the obligation of the Licensee, to purchase goods to any particular amount is concerned, and the agreement to make such purchases shall be enforced only in accordance therewith and not by any other remedy, legal or equitable; as to all other obligations of the Licensee the remedy given in this Section is merely cumulative, and shall not deprive the Licensor of any of its other legal or equitable remedies;

AND IT IS HEREBY MUTUALLY COVENANTED AND AGREED
By and between the parties hereto that:

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17. The price which the Licensor shall receive from the Licensee for gramophones and gramophone goods shall be the sum of the following three items, viz.: first, the actual manufacturing cost; second, a margin of 40 per cent. of the said manufacturing cost; and third, the royalty which the Licensor is required to pay to the United States Gramophone Company to the amount of 10 per cent. of the retail price of the said gramophones and gramophone goods;

18. The term "manufacturing cost" as used in this agreement shall be held to include the cost of labor, materials and supplies consumed in making the said gramophones, and gramophone goods, and parts for the repair thereof, and in their packing ready for shipment, and in their delivery f. o. b. cars or other means of transportation, designated by the Licensee at the place of their manufacture, the rents of manufacturing plants leased, and 6 per cent. interest on the cost of manufacturing plants owned, (provided such plants leased and owned shall not exceed the reasonable facilities for filling the Licensee's orders), insurance and taxes on such plants, and on materials and supplies used in connection therewith, and on

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goods in course of manufacture or completed, and all other items which relate exclusively to the process of manufacturing or are usually or properly charged to manufacturing account; but shall not include the salaries of officers nor the expense of maintaining the organization of the Licensor, or its office, or its correspondence, or of keeping its accounts, or of conducting its litigation, nor any damages for personal injuries to employees, nor any charges which are usually or properly classified in office account, or selling account—*Provided* That the laboratory expenses shall not be charged in the manufacturing cost of records, although the cost of the matrix, and the cost of talent, shall be included in the manufacturing cost of records, whether the records prove satisfactory to the Licensee or not;

19. If any arrangements are made between the United States Gramophone Company and the Licensor whereby the 10 per cent. royalty hereinbefore mentioned, is in any way decreased, the Licensor shall give the full benefit of this decrease in royalty to the Licensee;

20. Quarterly (on or about 1 January, 1 April, 1 July and 1 October in each year), the Licensor and Licensee shall

meet to estimate as nearly as possible the manufacturing cost of all styles of gramophones and gramophone goods, which the Licensor may be supplying, to the Licensee at that time, or the Licensor or the Licensee may desire to place upon the market. The cost, so estimated, shall be the basis for billing goods during the ensuing quarter, and at the end of the quarter, the Licensor shall correct the estimate according to actual experience, and any difference between the estimated cost shall be adjusted between the Licensor and the Licensee by the payment of the difference in cash;

21. At these quarterly meetings, the retail prices for the ensuing quarter shall be fixed and remain fixed until changed at a subsequent quarterly meeting, and shall form the basis for estimating the royalty hereinbefore mentioned. At these quarterly meetings the Licensee shall propose the retail prices to be fixed by the meetings, and the prices proposed by them shall be adopted and fixed—*Provided* That they shall not be less than the prices which the Licensee pays the Licensor, nor less than the wholesale or jobbers' prices which the Licensee receives—*And provided further* That, in no event, shall the royalty hereinbefore mentioned be less than fifty cents on any one gramophone—*And provided finally* That the retail prices so to be fixed shall be the prices at which the Licensee shall, in good faith and at all times, while the said retail prices are in force, sell gramophones and gramophone goods to purchasers at retail, and if the Licensee shall refuse to fix a retail price at the time of his order, then the retail price on the basis of which royalty is to be computed as hereinbefore covenanted shall be $2\frac{1}{2}$ times the price which the Licensor receives from the Licensee, for the said gramophones and gramophone goods—this royalty shall be subject to correction, should the Licensee at any time fix a higher price for the said gramophones and gramophone goods. Should the Licensee decide at any time to merely rent or lease any of the gramophones or gramophone goods, a special arrangement as to royalty shall be made with the Licensor.

22. The Licensor and the Licensee shall at all times exhibit their books of account to each other, when requested, in order to determine any questions in dispute under this agreement;

23. This agreement shall remain in full force and effect for a period of fifteen years from its date; and if, at the expiration

of that period any patent shall grant terms as in or corporate

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27. If Licensee party shall notify the thus appointed and chosen any two and binding hereafter such as the other point and so neglected effect as And, if the third, or

of that period, the Licensee desires a renewal hereof under any patents then existing and subject hereto, the Licensor shall grant such renewal to the Licensee, upon as favorable terms as it shall be willing to accord to any other individual or corporation;

24. All the agreements now existing between the Licensor and the Licensee are, by the execution of this agreement, made null and void, and all liability thereunder is hereby waived, except that any credit for money paid, which is now standing as due to the Licensee, may be hereafter applied in payment for gramophones and gramophone goods under this contract;

25. No alteration in, or waiver of the terms of this agreement, shall be valid unless reduced to writing, and signed and sealed by the Licensor and the Licensee;

26. This agreement shall be so construed, as not to require the Licensor or the Licensee, to violate any contracts with the United States Gramophone Company, or Emile Berliner, to which the patents hereinbefore mentioned, or the Licensor may be subject—especially the agreements between the United States Gramophone Company and W. C. Jones, dated 2 September, 1895, and 4 October, 1895, and the agreement between Emile Berliner and W. C. Jones, dated 2nd September, 1895, copies of which are hereto attached;

27. If any dispute shall arise, between the Licensor and the Licensee, regarding the interpretation of this agreement, each party shall appoint a disinterested arbitrator, and in writing notify the other of the appointment, and the two arbitrators thus appointed shall choose a third, and the three so appointed and chosen, shall decide the dispute; and an award signed by any two of the said three arbitrators shall be final, conclusive and binding upon both parties. And if either party, upon receiving from the other written notice to appoint an arbitrator as here aforesaid, shall neglect for a period of sixty days to make such an appointment, and to notify the other party as aforesaid, the other party, after appointing his own arbitrator, may appoint another disinterested person as arbitrator for the party so neglecting to make an appointment, and thereafter the arbitration shall proceed in the same manner, and with the same effect as if each party had appointed his own arbitrator. And, if two arbitrators when appointed cannot agree upon a third, or if, after three arbitrators have been appointed and

chosen, at least two of them have not agreed upon a decision, and signed an award within thirty days after notice in writing by either party to make an award, then the party giving such notice may determine the arbitration; and resort may be had to legal proceedings;

28. The term "Licensor" as used in this agreement shall be held to mean *the said* "Licensor," its successors and assigns; and the term "Licensee" as used in this agreement shall be held to mean *the said* "Licensee," his executors and administrators and the corporation to which, with the approval of the Licensor, as hereinbefore covenanted, the said Frank Seaman may assign the rights hereby granted to the Licensee;

29. The phrase "gramophones and gramophone goods" as used in this agreement shall be held to include, not only the machines and mechanical devices constituting the inventions hereinbefore mentioned and all the improvements in the said inventions that may come into the Licensor's control (except recording apparatus), but also all motors (except electric batteries) that may be adopted for driving the said machines and mechanical devices, as well as all other mechanism, appliances and accessories, that may be adopted as necessary or useful in handling, operating or using the machines or mechanical devices, which constitute the said inventions or improvements—for it is the intention hereof to refer by the phrase aforesaid, to the complete sound-reproducing machine, which may embody the said inventions and improvements, and all parts of the said machine, notwithstanding the fact that other inventions may also be embodied therewith in the said machine.

In Witness Whereof, The Licensor has caused this agreement to be signed in its name by the President and sealed with

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its corporate seal attested by its Secretary, and the Licensee has hereunto set his hand and seal, the day and year first above written.

BERLINER GRAMOPHONE COMPANY,

By

THOS. S. PARVIN,
President.

[Corporate
Seal.]

Attest:

MAX H. BIERNBAUM,
Secretary.

FRANK SEAMAN. [SEAL]

COMMONWEALTH
CITY AND COUNTY

BE IT RECORDED
A. D. 1896
Notary Public
Thomas S. Parvin,
and say that
Company, the
name of said
President of
Board of Directors
thereto is the
is affixed to
the said
foregoing instrument
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In Witness Whereof
fixed my hand and seal
A. D. 1896.

[Notarial
Seal.]

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In Witness Whereof
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[Notarial
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COMMONWEALTH OF PENNSYLVANIA, }
CITY AND COUNTY OF PHILADELPHIA, } ss.

BE IT REMEMBERED, That on this Tenth day of October A. D. 1896, personally came before me, the undersigned, Notary Public within and for the City and County aforesaid, Thomas S. Parvin, who, being by me duly sworn, did depose and say that he is the President of the Berliner Gramophone Company, the Licensor in the foregoing instrument; that the name of said Company is signed to said instrument by him as President of said Company by virtue of the order of the Board of Directors; that the seal of the Company attached thereto is the proper and genuine seal of said Company, and is affixed thereto by order of said Board of Directors; and the said Thomas S. Parvin, as President, acknowledged the foregoing instrument to be the act and deed of the Berliner Gramophone Company for the uses and purposes therein expressed.

THOS. S. PARVIN.

In Witness Whereof, I have hereunto set my hand and affixed my notarial seal of office, this Tenth day of October, A. D. 1896.

CHAS. H. BANNARD,
Notary Public.

[Notarial
Seal.]

COMMONWEALTH OF PENNSYLVANIA, }
CITY AND COUNTY OF PHILADELPHIA, } ss.

BE IT REMEMBERED, That on this Tenth day of October, A. D. 1896, personally came before me, the undersigned, a Notary Public in and for the City and County aforesaid, M. H. Biernbaum, who, being by me duly sworn, did depose and say that he is the Secretary of the Berliner Gramophone Company, Licensor in the foregoing instrument, that he affixed the seal of said Company thereto, and duly attested the same, by order of the Board of Directors thereof.

MAX H. BIERNBAUM.

In Witness Whereof, I have set my hand and affixed my notarial seal, this Tenth day of October, 1896.

CHAS. H. BANNARD,
Notary Public.

[Notarial
Seal.]

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK, } ss.

Before me, the undersigned, a Notary Public in and for the City and County aforesaid, personally came the above named Frank Seaman, who in due form of law acknowledged the foregoing instrument to be his act and deed for the purposes therein specified.

Witness my hand and notarial seal, this 12th day of October A. D. 1896.

[Notarial
Seal.]

W. M. ANDRUS,
Notary Public.
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"Exhibit B"

(Copy)

" *Exhibit B.* "

At a stated Term of the Circuit Court of the United States for the Southern District of New York, held at the Court Room thereof in the Post Office Building in the City of New York, this 5th day of May, 1900.

Present:

HON. E. HENRY LACOMBE,
Circuit Judge.

----- x	:
AMERICAN GRAPHOPHONE COMPANY,	: IN EQUITY.
	: No. 7063.
- against -	:
NATIONAL GRAMOPHONE COMPANY and	: On Patents No.
Frank Seaman.	: 341,214;
	: 341,288; and
	: 375,579.
----- x	:

This cause having come to be heard on motion for final decree in accordance with the annexed consent, it is on this 5th day of May, 1900, without costs to either party as against the other, ORDERED, ADJUDGED AND DECREED as follows:

That letters patent of the United States No. 341,214, granted May 4, 1886, to Chichester A. Bell and Sumner Tainter, No. 341,288 granted the same date to Sumner Tainter, and No. 375,579, granted December 27, 1887 to Sumner Tainter, for improvements in recording and reproducing speech and other sounds and for apparatus therefor, are each of them good and valid letters-patent; that the complainant the American Graphophone Company was, at the time of filing the bill of complaint herein, poss-

essed of the full and entire right, title and interest in and to the same, and is entitled to sue for and to recover to its own use and in its own name all claims for the infringement or violation of said letters patent or of any of them; and that the National Gramophone Company, one of the defendants herein, has infringed upon each of said letters patent and has violated the exclusive rights of the complainant under the same, by making or causing to be made, and using or causing to be used, and selling or causing to be sold, certain machines or apparatus for recording and for reproducing speech and other sounds, such talking machines being commonly known as Gramophones.

And it being shown to the Court that the Complainant and the defendant the National Gramophone Company have agreed on the amount to be recovered from the said National Gramophone Company by the Complainant in settlement of all claims for damages and profits on account of such infringement, and it further appearing that the said Defendant has duly paid such amount, it is further ordered that this settlement shall include all claims for damages or profits due to Complainant for infringement of its said letters patent by all purchasers of machines from said National Gramophone Company, or from its successor the National Gramophone Corporation; but that this settlement shall not include or effect the right of the Complainant to proceed against and recover

from the Berliner Gramophone Company, or the United States Gramophone Company, or any person, firm, or corporation from whom the National Gramophone Company or the National Gramophone Corporation has purchased infringing articles.

IT IS FURTHER ORDERED, ADJUDGED AND DECREED that a perpetual injunction issue against the defendant, the National Gramophone Company, in accordance with the prayer of the bill.

E. H. LACOMBE.
U.S. Circuit Judge.

We hereby consent to the entry and filing of the above decree.

PHILIP MAURO,
Of Counsel for Complainant.

Waldo G. Morse,
Solicitor and of Counsel for
the Defendant the National
Gramophone Company.

(Endorsed) U.S. Circuit Court, S.D.N.Y. - - American
Gramophone Company, against National Gramophone Com-
pany and Frank Seaman. -- In Equity, No. 7063. --
FINAL DECREE AGAINST ONE OF THE DEFENDANTS. --
Philip Mauro, of Counsel for complainant, 137 Broad-
way, New York City. -- U.S. Circuit Court, Filed May
5, 1900,
John A. Shields, Clerk.

(Seal of Cir. Court
South. Dist. of
New York)

(A Copy) John A. Shields,
Clerk.

"EXHIBIT C"

(Scribner's Magazine Advertisement for July, 1900)

ZON-O-PHONE

Improved Gram-o-phone.

-(Cut)-

Is substituted for the Gram-o-phone, which is abandoned, including its name.

The rights of the Zon-o-phone are exclusive under the joint protection of the patents of

National Gramophone Corporation

Universal Talking Machine Co.

American Graphophone Company.

Columbia Phonograph Company.

which companies have made an agreement between themselves for legal protection and commercial advantage. All persons selling and style of disc machine other than that sold by these corporations, will be prosecuted.

For sale by dealers everywhere, including the Branches of the Columbia Phonograph Co. throughout the world.

National Gram-o-phone Corporation,

Broadway, Cor. 18th St., New York City

"EXHIBIT D".

(Leslie's Weekly, August 4th, 1900).

ZON-O-PHONE

Improved Gram-o-phone.

Our Latest Improved 1900 Model is substituted for the Gram-o-phone, which is abandoned, including its name.

The rights of the Zon-o-phone are exclusive under the joint protection of the patents of

National Gram-o-phone Corporation.

Universal Talking Machine Co.

American Graphophone Company.

Columbia Phonograph Company.

which companies have made an agreement between themselves for legal protection and commercial advantage. All persons selling any style of disc machines other than the Zon-o-phone will be prosecuted.

National Gram-o-phone Corporation.

Broadway, Cor. 18th St., New York City

~~Editor 7~~

Metropolitan Magazine - September, 1900

Zon-o-phone

Improved GRAM-O-PHONE

Our Latest Improved 1900 Model is substituted for the Gram-o-phone, which is abandoned, including its name.

The rights of the ZON-O-PHONE are exclusive under the joint protection of the patents of . .

NATIONAL GRAM-O-PHONE CORPORATION
AMERICAN GRAPHOPHONE COMPANY
COLUMBIA PHONOGRAPH COMPANY
UNIVERSAL TALKING MACHINE CO.

which companies have made an agreement between themselves for legal protection and commercial advantage. All persons selling any style of disc machines other than the Zon-o-phone will be prosecuted.

National Gram-o-phone Corporation,
Broadway, cor. 18th St., New York City.

September 1900 Metropolitan

Johnson is National Gramophone Corp.

"EXHIBIT E".

Form No. 321- A.

New York. Philadelphia. Baltimore. Washington. Chicago.
St. Louis. Buffalo. San Francisco. Paris. Berlin.

Directors.

M.E. Lyle. Andrew Devine. F.J. Warburton. Edward D. Easton.
R.E. Cromlin. Thos. R. White, Jr. Philip Mauro. Wm. Herbert Smith.
John J. Phelps.

Executive Offices

AMERICAN GRAPHOPHONE COMPANY.

Columbia Phonograph Co.,

Sole Sales Agent.

Edward D. Easton, President.	Herbert A. Rudlong, Executive Officer.
M. E. Lyle, Vice President.	A. B. Cromlin, Assistant Executive Officer
Wm. Herbert Smith, Treasurer. (Cut)	F. Bischoff, Secretary.

Factory - Bridgeport, Conn.

135-137 Broadway, New York City, May 12th, 1900.

To Dealers in Gram-o-phones:

Some months since we issued a circular announcing that the Gram-p-phone infringed the patents of the American Graphophone Company, and that litigation was in progress for an injunction, accounting and damages.

We have recently concluded an arrangement with the National Gram-o-phone Corporation and the Universal Talking Machine Company, whereby infringement is conceded, the Gram-o-phone is by them withdrawn from sale, and a superior disc talking machine, known as the Zen-o-phone is substituted and offered to the trade under the joint protection of the Graphophone, National Gram-o-phone and Universal Talking Machine Company's patents.

We believe the Zen-o-phone to be so superior to the Gram-o-phone that we shall offer it for sale with graphophones in all of our establishments in the United States and Europe.

Dealers can arrange with the National Gram-o-phone Cor-

poration for an exchange of any Gram-o-phones they may have on hand, and by securing Zon-o-phones will thus be free from liability to us.

All who make, sell or use the Gram-o-phone or other forms of unlicensed disc machines are liable to prosecution for infringement.

Yours truly,

E.D. Easton,
President.

"Exhibit F"

(Copy)

Frank J. Dunham
President.

Orville D. La Dow, WM. T. Hepper
Sec'y & Gen'l Manager. Asst. Tres.

NATIONAL - GRAM-O-PHONE
CORPORATION.

cut
of
record

874 Broadway,
Cor. 18, St.

New York, October 26th, 1900.

TO THE TRADE

IMPORTANT.

*Letter of 10/27/00
Said to have
been enclosed
with this*

Dear Sir:--

You are already aware that our Gram-o-phone has been abandoned, name and all, and that the Zon-o-phone has been substituted therefor. As conflicting statements are being circulated by unprincipled parties, in order to deceive and confuse you as to the real status of affairs, we have concluded to give you the facts which cover the relation of the Gram-o-phone to the trade.

They are as follows: Emile Berliner was granted a patent for a Talking Machine called the Gram-o-phone. He sold it to The United States Gram-o-phone Company, and stepped out.

The United States Gram-o-phone Company licensed to the Berliner Gram-o-phone Company of Philadelphia, and stepped out.

The National Gram-o-phone Company succeeded to the

Johnson vs. National Gramophone Corp.

Gram-o-phone business, and the Berliner Gram-o-phone Company stepped out.

Judge Lacombe, of the United States Circuit Court of New York, decreed the Gram-o-phone to be an infringement of the Graphophone Patents. This action had been anticipated, however, and there had been developed a new and greatly improved Machine, which was called the Zon-o-phone, and which Machine combined joint patents of the Columbia Phonograph Co., American Graphophone Co. Universal Talking Machine Co., and National Gram-o-phone Corporation.

We thus settled three points. (1). We abandoned the Gram-o-phone, in accordance with the injunction of Judge Lacombe. (2). We substituted in its place the most perfect Talking Machine of any, by combining the best features of all. (3). We settled forever the legitimate title of the Zon-o-phone, as the only Disc Machine that can be legally constructed and sold.

Thereupon the Berliner Gram-o-phone Company attempted to jump back unto the business. It was promptly enjoined from so doing by the United States Circuit Court of Virginia. Exit Berliner Gram-o-phone Company.

Then The United States Gram-o-phone Company attempted to jump back, and was promptly met by an injunction of the United States Circuit Court of West Virginia. Exit United States Gram-o-phone Company.

The Berliner Gram-o-phone Company and the United States Gram-o-phone Company then attempted to combine, under the name of The Consolidated Talking Machine Company of America, and were promptly met by application of stockholders of the Berliner Gram-o-phone Company for a Receiver, and this combination was restrained.

Now comes the Consolidated Talking Machine Company "of America" omitted - the name under which Eldridge R. Johnson, the owner of a machine shop in Camden, New Jersey, who manufactured part of the Gram-o-phones up to the time that his business was interfered with by the United States Circuit Court. He is the manufacturer of the discredited Machine which we have abandoned--discredited because of the inferiority of his work which for years we have been obliged to admit, both to our disadvantage and shame.

We do not know what the remaining factor, Mr. Berliner will try to do, but it is a safe guess as to what will happen to him if he follows the example of the others.

This explanation necessarily involves personal references, which we regret. But our first duty is to enlighten our friends, so that they may understand the true situation, and to assure them that we are better prepared than ever to sell them goods, free from any taint of fear of results of patent litigation. Keep in mind that throughout all this patent litigation the National Gram-o-phone Corporation is free and clear.

Very respectfully,

NATIONAL GRAM-O-PHONE CORPORATION

By O. D. LaDow,

Secretary.

"EXHIBIT "G".

Saturday Evening Post. Oct. 20th, 1900.

So much superior that we have abandoned our Gram-o-phone, including its name. The Zon-o-phone is the only legitimate disc (flat record) talking machine; protected by the allied patents of American Graphophone Company, Columbia Phonograph Co., National Gram-o-phone Corporation, Universal Talking Machine Co.

ZON-O-PHONE
substituted
for our
GRAM-O-PHONE.

WARNING,- Parties who have recently attempted to trade in the Gram-o-phone, and reap the advantage of our prestige, have been enjoined. All others are warned as to the purchase and sale of machines bearing that name.

The ZON-O-PHONE records, by a newly discovered process, are incomparably superior to our Gram-o-phone records Zon-o-phones and Zon-o-phone records for sale everywhere. Send for Catalogues.

National Gram-o-phone Corporation,

874 Broadway, New York.

Branches, Chicago, 161 State. Boston 178 Tremont,

Philadelphia, 13 North 9th. San Francisco, Sherman Clay & Co

Exhibit A...

Saturday Evening Post - Oct. 20 - 1900

Zon-o-phone

SUBSTITUTED FOR OUR GRAM-O-PHONE

SO MUCH SUPERIOR that we have abandoned our Gram-o-phone, including its name. The **Zon-o-phone** is the only legitimate disc (flat record) talking machine: protected by the allied patents of American Graphophone Co., Columbia Phonograph Co., National Gram-o-phone Corporation, Universal Talking Machine Co.

WARNING.—Parties who have recently attempted to trade in the Gram-o-phone, and reap the advantage of our prestige, have been enjoined. All others are warned as to the purchase and sale of machines bearing that name.

The **Zon-o-phone** records, by a newly discovered process, are incomparably superior to our Gram-o-phone records. **Zon-o-phones** and records for sale everywhere. Send for Catalogue.

NATIONAL GRAM-O-PHONE CORPORATION, 874 Broadway, New York

BRANCHES: CHICAGO, 161 State. BOSTON, 178 Tremont. PHILADELPHIA, 13 North 9th. SAN FRANCISCO, Sherman Clay & Co.

Exhibit B

12

"Exhibit II"

Copy of Ad. of National Gramophone
Corporation in Century Magazine of
November, 1900.

"EXHIBIT I".

To THE TRADE.

We wish to warn the trade against efforts that may be made to market the Gram-o-phone, which we have abandoned including its name.

Parties who have attempted to place the Gram-o-phone upon the market were enjoined in June last from doing so by order of the U.S.Circuit Court.

Dealers are hereby warned as to the purchase and sale of disc machines which infringe our patents.

The Zen-o-phone is the only legitimate disc talking machine; it is protected by the allied patents of the American Graphophone Company, the Columbia Phonograph Company, the National Gram-o-phone Corporation/and the Universal Talking Machine Company

National Gram-o-phone Corporation,

374 Broadway, New York. N.Y.

October 10th, 1900.

Branches:

Boston, 173 Tremont Street; Providence, 457 Westminster Street
Philadelphia, 13 North Ninth Street; Chicago, 1616 State Street;
Cincinnati, 21 and 23 W Fifth Street; Albany, N.Y. 466 Broadway;
Denver, Colo. 1509 Tremont Street.

Exhibit **E**.

Postal Card addressed by me
received by Mr. John H. Frank, Director,
Comptroller - Postmaster, Oct. 11 1900.

Commonwealth of Pennsylvania)
City and County of Philadelphia.)

Horace Sheble, of the City of Philadelphia, State
of Pennsylvania, being duly sworn deposes a

TO THE TRADE.

We wish to warn the trade against efforts that may be made to market the Gram-o-phone, which we have abandoned, including its name. Parties who have attempted to place the Gram-o-phone upon the market were enjoined in June last from doing so by order of the U. S. Circuit Court.

Dealers are hereby warned as to the purchase and sale of disc machines which infringe our patents.

The Zon-o-phone is the only legitimate disc talking machine; it is protected by the allied patents of the American Graphophone Company, the Columbia Phonograph Company, the National Gram-o-phone Corporation, the Universal Talking Machine Company.

NATIONAL GRAM-O-PHONE CORPORATION,
874 BROADWAY, NEW YORK, N. Y.

October 10th, 1900.

BRANCHES:
BOSTON, 178 Tremont Street; PROVIDENCE, 457 Westminster Street; PHILADELPHIA,
13 North Ninth Street; CHICAGO, 161 State Street; CINCINNATI, 21 and 23 W. Fifth Street;
ALBANY, N. Y., 466 Broadway; DENVER, COLO. 1509 Tremont Street.

Exhibit J

New York London Paris Berlin Chicago St. Louis Phila-
delphia Baltimore Washington Buffalo San Francisco.

Telephone 1 Cortlandt.

Executive Offices

Cut of
Factory. AMERICAN GRAPHOPHONE COMPANY.
Columbia Phonograph Company, Sole Sales Agent.

Edward D. Easton	Directors.
Pres. & Gen'l. Manager M. E. Lyle	Thos. R. White Jr.
M. E. Lyle,	
Vice Pres.	Andrew Devine Philip Mauro.
Herbert A. Budlong,	
Executive Officer.	F. J. Warburton Wm. H. Smith.
Wm. Herbert Smith,	
Treasurer.	E. D. Easton. John J. Phelps.

R. F. Cromelin.

Office of the President.

135 - 137 Broadway.

New York City. Oct. 17 1900.

TO THE TALKING MACHINE TRADE:

Our attention has been directed to a pamphlet bearing the name of the Consolidated Talking Machine Company and describing a talking machine which is identical with that involved in the suit brought by this Company against the Gramophone and which has been enjoined by the Circuit Court of New York as an infringement.

This being apparently an attempt by the owners of the said machine to evade and shift upon others the responsibility for marketing an infringing device, we desire to inform all dealers that persons handling the same will

Eldridge Johnson is National Gramophone Corp

render themselves liable to suit by this Company for an
injunction and damages.

AMERICAN GRAPHOPHONE COMPANY,

By E. D. Easton.
President.

"EXHIBIT K"

Frank J. Dunham
President.

Orville D. LaDow,
Sec'y & Gen'l Manager.

Frank Seaman,
Treasurer.

NATIONAL GRAM-O-PHONE CORPORATION.

874 Broadway,
Cor. 18, St.

(Cut)

New York, May 18th, 1900.

Dear Sir:- We make the following statement for the benefit of all concerned:

The National Gram-o-phone Corporation and the Universal Talking Machine Company have formed an alliance with the American Graphophone Company and the Columbia Phonograph Company, for the mutual advantage and protection of the disc talking machine trade.

On May 5th a decree was entered by Judge Lacombe, of the United States Circuit Court, decreeing the talking machine Gram-o-phone to be an infringement of the Graphophone patents. The Gram-o-phone is therefore abandoned and the infringing features heretofore found by Judge Lacombe in his decision granting a preliminary injunction are by this joint agreement at the disposal of the National Gram-o-phone Corporation.

The various patents of the above alliance are now merged in a new disc-machine to be known as the Zon-o-phone, which becomes the 1900 model of the Gram-o-phone

Corporation and is now ready for the market.

The rights of the National Gram-o-phone Corporation therein are absolute and exclusive, and the rights of the trade to deal in the Zon-o-phone are conceded by all parties. The rights of the Zon-o-phone being exclusive, the alliance will operate jointly in defending and enforcing such rights against every other form of disc-machine.

Graphophone suits against dealers in Gram-o-phones will be withdrawn in cases where the sale of the infringing machine is abandoned and the Zon-o-phone substituted therefor.

The continued sale of the Gram-o-phone will entail prosecution.

Blanks for agreement to these conditions will be provided.

The National Gram-o-phone Corporation will make special agreements for the exchange of Gram-o-phones for Zon-o-phones, and is authorized to make arrangements for the disposition of Gram-o-phones now on hand. For the Graph-o-phone Co., they recognize the Zon-o-phone - its superior merits as a machine and its undisputed legal status - by placing it on sale, in connection with Grapho-phones, at their principal stores throughout the world.

The Zon-o-phone will please you immensely. It's new it's novel, it's handsome, it's artistic, it's something to talk about; it's free from patent litigation, its work

is ten times better than a Gram-o-phone, it's the talking machine of the times.

The Zon-o-phone is made in three types: Type A, with bevelled plate glass sides, and brass horn, \$25; Type B, with quartered oak sides, and brass horn, \$22.50; Type C, including all Zon-o-phone improvements, furnished with heavy japanned horn, \$18.00.

In conclusion, we congratulate the trade on the final disposition of this question, and bespeak for the operations of the alliance abundant success and freedom from future annoyance on the subject of patent litigation.

Very respectfully,

NATIONAL GRAM-O-PHONE CORPORATION,

Secretary.

"EXHIBIT L"

Philip Mauro

PHILIP MAURO

Cable address,
"Mauro-Washington"

Counsellor at Law. (Liebers Standard Code)

Telephone

S.T.Cameron.

I 620 F.St., Washington, D.C. Washington, 1394

Reeve Lewis.

Offices: I

N.Y., 1, Cortlandt.

C.A.L.Massie.

I 137 Broadway, New York.

New York, June 27th, 1900.

Dear Sir:-- The undersigned, counsel respectively for the American Graphophone Company the Columbia Phonograph Company and the National Gram-o-phone Corporation, acting in their joint interests, beg to confirm the information which you have already received relative to the agreements recently entered into between the above named Companies. As an agent of the National Gram-o-phone Corporation you are protected in handling its product, by all the patents owned or controlled by all the Companies parties to said agreement. We are requested by our clients to convey to the agents and dealers of the National Gram-o-phone Corporation the assurance that, in the sale of Zon-o-phones, records and supplies, they will receive the full legal protection afforded by said patents.

In the event of any attempt by unauthorized persons to place on the market disc machines such as have been held to be infringements of patents controlled by the above interests, we will be obliged to you for prompt and complete information. Our instructions are to enforce the above described patents by appropriate legal proceed-

ings against all infringing makers, dealers or users.

Respectfully,

PHILIP MAURO.
Counsel for American Graphophone
Company and Columbia Phonograph Co.

WALDO G. MORSE,
Counsel for National Gram-o-phone
Corporation.

CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York.

In Equity.

The American Graphophone Company,
Complainant

VS.

National Gramophone Company, and Frank Seaman
Defendants.

Sur Motion to withdraw Defendants' Record and
Appearances from Case.

AFFIDAVIT OF CALVIN G. CHILD

Commonwealth of Pennsylvania,)
) ss.
City and County of Philadelphia.)

Calvin G. Child being duly sworn according to law, deposes and says that he is a resident of the city of Philadelphia, State of Pennsylvania, and is now and has been for a number of years past engaged in the talking machine business, and particularly in that branch relating to the manufacture of records.

This deponent states that in December, 1896 he was employed by the National Gramophone Company, the defendant in this case ; that he was engaged at that time by

Frank Seaman, and his salary fixed by him after an interview with William Barry Owen, the then manager of the National Gramophone Company; that the deponent was employed to take charge of a laboratory in the city of New York for the purpose of making records for the gramophones which were to be sent to the matrix plant of the Berliner Gramophone Company when finished for the purpose of having matrices made to supply the said Seaman with records for his trade ; that this laboratory was a privilege extended to the said Seaman by the Berliner Gramophone Company ; that the recording machines, diaphragms and other appliances were loaned to the said Seaman by the Berliner Gramophone Company and it was distinctly a part of the said Seaman's contract that he had no right to make nor to have made machines for the purpose of making records for the gramophone or to have in his possession matrices or records which were made by any other process than that of the Berliner Gramophone Company ; that the employees' salary, running expenses, bills for talent, , chemicals, etc. including deponent's salary in the said laboratory were paid by the National Gramophone Company; that the signs upon the doors of this laboratory in various locations were "Laboratory of the National Gramophone Company" ; that the deponent's cards bore the name of the National Gramophone Company .

The deponent states that all matters of importance in the conduct of the said laboratory of the National Gramophone Company, and particularly matters where con-

siderable sums of money were involved, were referred to the said Seaman and settled by him; that the deponent invariably consulted the said Seaman and the manager of the National Gramophone Company together on such points as this and that the said Seaman's instructions and decisions were final in all such matters; that on one occasion in the spring of 1898 the said Seaman desired that the laboratory should be moved from its location at that time, 54 West 22nd Street, to the McIntyre Building at the corner of 18th St. and Broadway where the offices of the National Gramophone Company and of the said Seaman were located; that the rooms selected for the laboratory were shown to this deponent and this deponent stated that they were absolutely unfit for the work; that the then manager of the National Gramophone Company, Mr. O. D. LaDow agreed with deponent, but said that the said Seaman was furnishing the money which was being expended for this work and that he thought that it was well to let him have his way and the laboratory was moved to the McIntyre Building for one week; the rooms being then found unsuitable, the said Seaman personally secured a temporary location at the corner of 4th Avenue and 23rd Street in the United Charity Building; that the laboratory was then moved to 34 West 24th Street, and it was with great difficulty that the deponent could get the said Seaman to consent to taking these rooms, the said Seaman objecting on account of two long flights of stairs, and also stating that he did not think that the rooms were sufficiently pretentious or in a desirable

location for people of prominence whom he hoped to be able to bring to the laboratory for making of records.

That deponent and all the other employees of the National Gramophone Company considered the said Seaman the supreme head of the business; that the said Seaman was in the habit of giving a yearly picnic on Decoration Day at his residence in Yonkers to the employees of the National Gramophone Company and the deponent was asked to attend these picnic and to secure the services of singers and musicians who had worked in the Laboratory to give entertainment at such picnics; that for two years all employees of the National Gramophone company received a personal Christmas gift from the said Frank Seaman.

The deponent further states that during the fall of 1897 and spring of 1898 exhibitions were given in New York, Brooklyn, and Boston, under the auspices of the National Gramophone Company of the methods in which the records for the Berliner Gramophone were made; that the deponent had personal charge of all these exhibitions and ^{had} to consult and settle all matters with the said Seaman; that the said Seaman personally attended all these exhibitions and frequently sent instructions by messenger back of the stage to the said deponent as to changes which he would like to have made as to what was being done.

The deponent further states that shortly before Christmas, 1897, in an interview in New York with the said Seaman and said LaDow, he was told that the Nation-

al Gramophone Company and the said Seaman wished to place themselves in such a position that they might be independent of the Berliner Gramophone Company in all branches of the business should they desire at any time to do so; that the said Seaman asked the deponent if he would conduct some experiments in making matrices; that these experiments were begun immediately after Christmas in 1897 and that Theo.A.Wangamann ,of Flushing,Long Island,was engaged by the deponent to assist him in this work and that the work of making matrices was done by Rhinebeck & Sons,Electro-typers,of New York; that this work was continued until the middle of March;and all samples and experiments made were submitted to the said Seaman and said LaDow for criticism and approval; that the records used for these experiments were made with the appliances loaned to the said Frank Seaman by the Berliner Gramophone Company,although,as the deponent has since learned it was in direct violation of the contract for said Seaman to make such experiments or to have in his possession such matrices; that all these experiments were conducted with the consent and approval of the said Frank Seaman and all final results shown to him,and the deponent made a written report on this work which was given to the said LaDow and was placed by him in the deponent's presence in the safe in the said Seaman's private office.

The deponent further states that the Berliner Gramophone Company notified the said Seaman in the fall of 1898 that they would remove the Laboratory to Philada.

on January 1st, '99, and with the approval and consent of the said Seaman made a proposition to the deponent to come to Philadelphia and take charge of the Laboratory for them; that the Laboratory was removed from New York about the 20th of January, 1899, a continuance having been granted at the request of the said Seaman to the time for work in New York to finish some special records which had been engaged for there, principally some records by Victor Herbert's Band; that during the time deponent had charge of the said Laboratory in New York, all arrangements were made by him directly with performers known as the "talent" for record work; that after he came to Philadelphia for some little time an effort was made to make these arrangements in New York for records which were to be made on order of the said Frank Seaman by the Berliner Gramophone company; that for various reasons this plan did not work successfully and that the deponent frequently went to New York to make arrangements with the said Seaman for further engagements of talent; that early in the fall of 1899 the deponent while at lunch at the French restaurant, Corner 18th St. and 5th. Avenue, with the said Seaman and the said LaDow, suggested to the said Seaman to go back to the arrangements which were had in New York and to allow the deponent to make engagements for him for such records as he deemed were salable and would be an addition to the catalogue, and that the said Seaman agreed to this arrangement ex-

cepting so far as it concerned engagements for concerted work, such as Band, Orchestra, etc. where large amounts of money were to be expended, and on these engagements he reserved the right to be consulted; that this plan was entered into and carried out successfully until April 10, 1900, when the Berliner Gramophone Company received a letter from the said Seaman stating that he wished to make no further engagements or wished the deponent to make no further engagements for talent to make records for him without taking him into consultation on each engagement and getting his approval of the number of records to be made and the price to be paid therefor; that the deponent dictated a letter for the Berliner Gramophone Company requesting that Seaman should change his mind on this matter as it was of great advantage to the business in general not have engagements delayed but to run them along as they were needed; that the deponent went to New York and consulted with the said Seaman and the said Seaman agreed to write to the Berliner Gramophone Company and return to the former arrangement in regard to engaging talent, but the said Seaman failed to write this letter, and as a number of engagements had been booked in advance the Berliner Gramophone Company filled these engagements in order not to violate agreements made by their representative, the said deponent, with the "talent".

The deponent was from time to time sent to New York by the Berliner Gramophone Company to consult with the said Seaman in regard to records which had been made and to receive from him suggestions as to what he would like to have done in the line of Laboratory work and to find out if possible what the needs of the business were so that they might in every way comply with them; that on these trips to New York as a rule the deponent went to luncheon with the said Seaman and said LaDow; that suggestions were made by LaDow and the deponent, the final decision as to their adoption or rejection being made by the said Seaman; that during this period the said LaDow was President of the Universal Talking Machine Company and the said Seaman was Treasurer of the National Gramophone Corporation; that this deponent was aware that experiments were being made by the Universal Talking Machine Company in record making and that records had been made and finished by them; that on several occasions he asked the said LaDow to show him some of their records, but an excuse was always made; that during a visit ~~at~~ to New York in April, 1900, the deponent asked the said Seaman why it was that he could not hear any records of the Universal Talking Machine Company; that the said Seaman requested the said LaDow to let deponent hear some of these records and that the said LaDow, who had previously stated he had none excepting at his own house took from a cabinet in his office, three records - a Trombone Solo "Ava Maria"; a

record of the "Drinking Song" from "Martha" sung under an assumed name by Emilio de Gegerze, who makes records for the Berliner Gramophone Company and other talking machine companies under the name of Signor Francisco, and also a record of "How was I to know" by Edw.M.Favor; that the said Seaman stated to deponent he could not wait while he listened to records but wished to see him later in the afternoon before his return to Philadelphia; that the deponent went to the said Seaman's office and the said Seaman asked deponent what his opinion of the records was, and if he would write to him, the said Seaman- a personal letter giving deponent's personal opinion in regard to these records, as he, the said Seaman, would like an expert opinion referring to them.

Deponent further avers that for some time efforts were made and it was the desire of the said Seaman to keep the name "Gramophone" as much in the background as possible; that in the Spring of 1898, the deponent changed the style of type used for marking the records and carried a sample to the said Seaman for his approval; that the said Seaman approved of the type and thought it much clearer than that formerly in use, and said to the deponent that while it was a good idea to have the title clear, he wished he would not be too particular about the patent stamp bearing the name E.Berliner Gramophone, with dates of patent; that he did not care how much that

was blurred or obliterated.

Deponent also states that in the catalogue issued in October, 1898, proof of which he read and part of which was compiled by deponent, he called the said Seaman's attention to the fact that in the introduction, which had been corrected by the said LaDow for the National Gramophone Corporation, a paragraph appeared with the word "Zonophone" and the deponent asked the said Seaman if it had not been agreed between himself and the Berliner Gramophone Company that this name should not be used in further advertisements of any kind; the deponent also asked the said Seaman what was the meaning of the word "Zonophone" and the said Seaman replied that it was a coined word without meaning but with a special use, and that he desired it to remain in its place in the catalogue.

Deponent further states that the statement in said affidavit in reply to the representation of Sousa's Band is in every respect a misrepresentation. There was no accusation of any kind made by the said Seaman; that the deponent on entering the office of the National Gramophone Company 874 Broadway, met the said Seaman and Mr. O.D. LaDow, Manager of the National Gramophone Corporation; that deponent was asked about the records made by ~~Sou-~~ ~~xxx~~ Sousa's Band; that there was no attempt on the part of the Berliner Gramophone Company or the deponent to

conceal the fact that an engagement had been made with Sousa's Band for the production of records. The reason the said Seaman had not been consulted on this engagement was that for some ~~time~~ months past the privilege of making records from Sousa's Band had been withheld because the said Seaman and the National Gramophone Company had violated the privilege which had been accorded to the said deponent by Sousa and they had led the public to believe that John Philip Sousa was connected with these engagements personally and had also published in the newspapers a letter of Frank Christianer, General Agent of Spusa's Band, which was given sole for use in the catalogue; that they had changed the signature from General Agent to General Manager, and caused much trouble between Mr. Christianer and the management of Sousa's Band; that the said LaDow had entered into an agreement with Mr. Reynolds, Manager for Sousa, to pay him a certain amount for a year for advertising in the Sousa programs, and for the use of the Band; that the said LaDow had made this arrangement on behalf of the National Gramophone Company and had failed to keep it. For these reasons the deponent was denied the privilege of making records from Sousa's Band for some months, and only succeeded in obtaining Sousa's consent in April; that the engagement was made by the Berliner Gramophone Company

because the felt sure that if the said Seaman and National Gramophone Corporation were taken into consideration, the privilege would be again denied.

At the time the engagement was made, it was the intention of the Berliner Gramophone Company to submit samples of records from these matrices when finished to the said Seaman and to offer him the engagement at cost plus the contract agreement of 40 per cent; that deponent explained these facts to the said Seaman and further stated that he presumed the engagement would be offered to him (Seaman) immediately upon Mr. Parvin's return from Florida; that the deponent was asked what the engagement cost, and he said with all expenses attached, including a trip to Washington to make arrangements in the neighborhood of \$1,000; that there was nothing whatever said in regard to bills being sent to the said Seaman for this engagement either by the said Seaman or the said deponent.

The deponent further avers that to the best of his knowledge and belief from instructions given to him by the said Seaman and from his actions and various conversations that the said Seaman was making every effort to place himself and the National Gramophone Company in a position where they could be entirely independent of the Berliner Gramophone Co.

Sworn to and subscribed to before me this *Thirty first*
October
day of ~~November~~, 1900.

G. G. Child
Charles G. Packman
Notary Public

CIRCUIT COURT OF THE UNITED STATES

For the Southern District of New York.

In Equity.

The American Graphophone Company,
Complainant.

vs.

National Gramophone Company, and Frank Seaman.
Defendants.

Sur Motion to withdraw Defendants' Record and
Appearances from Case.

AFFIDAVIT OF CHARLES S. LYTLE

State of New York,)
) ss.
City of New York.)

Charles S. Lytle, being duly sworn deposes and
says: I reside at 1750 Amsterdam Avenue, New York City.
From February, 1896, until August 28, 1900, with the excep-
tion of a few weeks in the summer of 1896 and from Feb-
ruary to June 1897, I was in the employ of the New York

Gramophone Company, the National Gramophone company, and the National Gramophone corporation.

In 1896, Frank Seaman's office as an advertising agent was on the ninth floor of the building 874 Broadway, which is the N.E. Corner of 18th and Broadway, and is known as the McIntyre Building. The New York Gramophone Company, of which Frank Seaman was president, had three rooms on the ninth floor of 874 Broadway. These rooms were not connected with Frank Seaman's office as advertising agent. Early in 1896 the New York Gramophone company moved its offices to the Lincoln Building. When the National Gramophone Company was organized, the New York Gramophone Company dropped out of sight, and the National Gramophone company occupied the offices of the New York Gramophone Company in the Lincoln Building, and also its store, 27 E. 14th St. At that time, the National Gramophone Company's letter heads and bills had on them the words "Frank Seaman, Proprietor". Early in 1897, the National Gramophone Company moved its offices, but not its store, from the Lincoln Building to 874 Broadway. While the National Gramophone Company had its offices in the Lincoln Building, the mail would all be sent to 874 Broadway, and it was brought down from there. In the summer of 1897 changes were made in the offices in 874 Broadway so that Frank Seaman was established in the front office of the third floor of 874 Broadway. O.D. Ladow occupied an

office separated from Seaman's office by a partition about 8 ft. high and connected with a communicating door. At one time or another ~~the~~ during the last three years the National Gramophone Company and its successor, the National Gramophone Corporation, has occupied rooms in 874 Broadway on the first floor (store), a room on the second floor, rooms on the third floor, rooms on the fifth floor, rooms on the sixth floor and rooms on the ninth floor. For some time during 1899 it was well understood by myself and other employees that Mr. English, now openly known as the Record Maker of Universal Talking Machine Co. was making Records in a room on the tenth floor.

I have examined the records referred to in the affidavit of Wm. Henry Nafey, numbered respectively 80092, 01136V and 5904, and in my opinion the three records bought by Mr. Nafey at the store of the Universal Talking Machine Company are records made from matrices which were made from commercial records of the Berliner Gramophone.

During May, June and July of 1900, at different times I have been in Room 905 of 874 Broadway, and have there seen a man named Miller, who was employed by the Universal Talking Machine Company, and Anthony Shromack, who was employed by the National Gramophone Corporation, at work erasing the Berliner Patent marks and fac-simile signature of artists from matrices which had apparently been made from the Berliner records.

during May, 1900, I was receiving clerk of the National Gramophone Corporation, and in that ~~company~~ capacity I received and distributed about 700 circulars printed under the letter head of the American Graphophone Company, ^{and} signed by A.D. Easton, President, and a copy of this circular is hereto annexed, and marked "Exhibit E".

I have made this affidavit because I believe from what I have seen and heard and have had knowledge of during the last eighteen months that a great wrong has been done to the Berliner Gramophone Company, and I believe it my duty in so far as it is in my power to prevent the consummation of this wrong.

Sworn and subscribed to before me this
October
day of ~~November~~, A.D., 1900.

Chas. J. Lytle
Thirty first
Charles J. Lytle
Notary Public

CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York.

In Equity.

The American Graphophone Company,
Complainant,

vs.

National Gramophone Company, and Frank Seaman,
Defendants.

Sur Motion to withdraw defendants' Record and
Appearances from Case.

AFFIDAVIT OF WILLIAM NEWCOMB.

New York
State of ~~Pennsylvania~~ I
New York ISS
City and County of ~~Philadelphia~~ I

William Newcomb, being duly sworn according to
law deposes and says as follows:-

1. In October or November 1896 I became acquainted
with the gramophone business in New York and with Will-
iam Barry Owen who was then the manager of the National

Gramophone Company. I made some sales of gramophones and gramophone goods for the National Gramophone Company and was afterward introduced by Mr. Owen to Frank Seaman, who was then the president of the National Gramophone Company. It was proposed that I should enter the employ of the National Gramophone Company, to organize and manage the "scheme goods" department. "Scheme goods" means goods that are not to be sold at retail, but are to be given away by merchants, with other goods, as premiums, to promote the sale of the goods. I had some correspondence with Frank Seaman, and I attach to this affidavit and mark "W.N. Exhibit A" a letter dated 1/7/1896 (it was in reality 1/7/1897) which I received from Frank Seaman which led to negotiations culminating in the making of a written contract. The letter is entirely in the handwriting of Frank Seaman. X X

The written contract which was afterward entered into between the National Gramophone Company and myself was dated the 18th day of January, 1897 and was signed by Frank Seaman as President of the National Gramophone Company and by me. At that time Frank Seaman was undoubtedly in supreme control of the National Gramophone Company and all its business and after the contract was signed he gave me from time to time explicit directions and instructions about my duties and continued to do so until my contract expired about one year later.

According to the terms of my contract I was to have an accounting at the end of the first six months and each three months thereafter. Repeatedly I requested this accounting but was unable to get any accounting and upon being ordered West by Frank Seaman on a trip I placed the matter in the hands of my lawyer, who after ward being unable to get an amicable settlement, brought a suit against the National Gramophone Company and Frank Seaman in which I was successful. As the result of this suit a settlement was made by my lawyer and in that settlement he took a release on the 11th day of February 1898 from the National Gramophone Company to me ~~and a copy of which is attached to my affidavit and marked "W.N. Exhibit B". I will produce the original if desired.~~ It is dated the 11th day of February 1898 and signed National Gramophone Company Frank Seaman Treasurer and witnessed by Frances Crouch.

2. Frances Crouch is a lady employed at 874 Broadway New York who was at the same time private secretary of Frank Seaman and during the entire time that I have known Frank Seaman the National Gramophone Company, and the National Gramophone Corporation, has been authorized and accustomed to open all the mail for all those parties.

3. Early in the year 1898 the Universal Talking Machine Company was formed.

4. In the summer of 1898 I answered an advertisement in a New York paper for an assistant manager for the National Gramophone Company. The advertisement was signed by the National Gramophone Company and the address given was 874 Broadway New York. I answered the advertisement by writing a letter to Frank Seaman and in that letter I asked if there was any opening for me. He answered that that position was filled but he would be very glad to have me call and talk matters over as he thought there was another opening for me. I then called on Frank Seaman at 874 Broadway, and he assured me that there was no hard feeling about the litigation to which I have referred above, and he then told me to see Mr. Orville D. LaDow who was the manager of the National Gramophone Company. Mr. LaDow's Office was on the same floor of the same building and was separated only by a communicating door between the two offices. There was a low partition from Mr. Seaman's office. Frank Seaman called LaDow immediately into his office and LaDow took up the conversation with me and Frank Seaman dropped out of it but before he called LaDow he told me in words as nearly as I can remember: "LaDow does not bear you any ill will on account of the late litigation and I think you will have no difficulty in coming to terms with him as I would like to see you resume your former position with the Company. However, if you cannot come to satisfactory terms come and see me after you have had your talk and I will fix it for you." In this interview

Frank Seaman told me also that "at last we have a perfect slot machine and LaDow will tell you about it." This turned out to be the slot machine of the Universal Talking Machine Co.

After I had had my talk with LaDow I saw Frank Seaman again on the same day and reported to him that LaDow and I had come to a satisfactory arrangement and that I was going out on the road to represent the National Gramophone Company and the Universal Talking Machine Company and Frank Seaman replied that he was very glad to hear of it.

This occurred in August 1898 and I immediately went out on the road representing both the National Gramophone Company and the Universal Talking Machine Company. Before I started Frank Seaman spoke particularly about my arranging my trip so as to take in St. Paul, giving specific instructions regarding Messrs W. J. Dyer & Bro., the agents for the North West, requesting me immediately on arrival at St. Paul to go to their store and find out if they were selling the "Diamond M" scheme machine at retail at the same price as the regular gramophone contrary to their agreement with the National Gramophone Company and to lose no time on the way to get to St. Paul as quickly as possible and if I found that they were offering the above machine for sale, to purchase one, get a receipted bill and communicate with New York at

once. He gave me those instructions personally. Under the terms of my agreement as fixed on this question, half my salary was to be paid by the National Gramophone Company and half of my salary was to be paid by the Universal Talking Machine Co. I was employed to sell both the gramophone and the Universal Talking Machine Company's slot machine which was the machine including the gramophone and was operated by dropping a nickle or a penny in the slot.

5. I was further instructed to address all orders and my correspondence to the National Gramophone Company 874 Broadway, including not only orders for the National Gramophone Company but also orders for the Universal Talking Machine Co. and as long as I continued in the employment I complied with these instructions and duly addressed all correspondence to the National Gramophone Company 874 Broadway. Included in these orders were not only orders to the National Gramophone Company for gramophones but also to the Universal Talking Machine Co. for slot machines. I continued in this employment until October 1898. About my expense account the instructions were different. I was instructed not to separate my accounts against the National Gramophone Company from my accounts against the Universal Talking Machine Company but to render only one expense account to the National Gramophone Company and in this account

I was directed to include both my National Gramophone Company's expenses and my Universal Talking Machine Company's expenses ~~xx~~ without making any distinction between the two. I followed these instructions to the letter and rendered my expense account weekly, addressing them always to the National Gramophone Company, 874 Broadway, New York.

6. During this period of my employment from August 1898 to October 1898 all my salary for selling both National Gramophone Company's gramophones and for selling Universal Talking Machine Company's slot machines was paid by the National Gramophone Company ^{with its} check and all my expense accounts in like manner were paid by the National Gramophone Company with its checks.

7. Referring again to Frank Seaman's personal instructions to me to go to St. Paul I followed these instructions and when I reached St. Paul ^{Frank Seaman} sent me through D.L. Thorp of Chicago, orders for railroad transportation which I presented at the railroad offices, and on which I obtained free transportation in the shape of "editorial mileage books" which were charged to advertising account by the railroad. This charging of the books was by the railroad officials on the books themselves and it was further stated that the books were issued on account of Frank Seaman. D.L. Thorp of Chicago was at that time

the agent of Frank Seaman in his advertising business and also the agent for the National Gramophone Company for the sale of Gramophones. While at Madison, Wisconsin, I met the head salesman for Messrs Turner Looker & Co. of Cincinnati Ohio, who claimed to be the largest scheme goods firm in the United States. I showed him a large photograph of the new style "J" scheme gramophone. At his request I wrote to the National Gramophone Company suggesting that I visit Cincinnati as I was led to believe that I could make a very large contract with the above firm on this machine and asked permission to go there. On my arrival at Milwaukee I received in response to this letter a telegram from Frank Seaman, which is as follows:--

New York, N.Y. Aug. 15, 1898.

Wm. Newcomb, Plankinton Hotel.

LaDow away suggest going to St. Paul as routed will advise there think best you go Cincinnati nine dollars probably all right.

Frank Seaman.

The meaning of the phrase "\$9 probably all right" in the above telegram is this; the price that I had been given for Style "J" scheme gramophone above mentioned before leaving New York was \$10. My letter above mentioned asked permission to shade the price to \$9 for large lots. I accepted Frank Seaman's telegram as full authority in response to my letter to shade the rates on

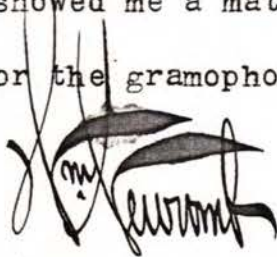
National Gramophone Company's price on that machine from \$10 to \$9, and acting on this assumption sold machines at that price \$9 to the firm above mentioned. At this price the National Gramophone Company afterward supplied the goods that I sold.

8. In October 1898 I discontinued my relations with the National Gramophone Company because they were not able to fill my orders and therefore my business did not pay them.

9. At the time my employment with the National Gramophone Company and the Universal Talking Machine Company terminated in October 1898 I returned to New York and at the invitation of Orville D. LaDow I called frequently at his office above described at 874 Broadway New York. I frequently saw Frank Seaman on these occasions sometimes in his own room and sometimes in LaDow's room (which as I have said above was immediately adjoining and was separated only by a low partition and was connected by a door) and sometimes I saw him in his own room or sometimes in the reception room outside of both of these rooms. At LaDow's request I called at least once a week for many weeks. Early in the year 1899 I had an appointment one day to meet LaDow to see a "perfect" slot machine which the Universal Talking Machine Company was getting ready to put on the market. LaDow was busy with

some customers in his own office and Frank Seaman came into the reception room and hailed me cordially and said "Are you coming back with us Newcomb?" I replied that LaDow had sent for me as I understood to see a "perfect" slot machine and I was waiting his pleasure. Seaman replied that he believed they were all ready for me and that he wanted me to bear in mind that in starting out on a trip I had better make a start for the Pacific coast.

10. On one of these occasions when I called at LaDow's office in 874 Broadway, LaDow pulled open a drawer in his desk and showed me a matrix such as is used in making records for the gramophone.



Sworn and subscribed before me this 12th day of
November A.D., 1900.

Lillie Freeland
Notary Public.
N.Y. Co. (No. 19)

EXHIBIT ATTACHED TO AFFIDAVIT OF WILLIAM NEWCOMB.

W.N.Exhibit A.

Frank Seaman,

General Advertising.

Branches

Allen Advertising Agency, 1227 Broadway.

Chicago Office, 79 Dearborn Street.

Main Offices:

874 Broadway, New York 1/7/1896.

Dear Mr. Newcomb: Been trying all day to write you & now the Stenographers have gone & I have pen cramp. My idea is to establish a separate & distinct department in the National Gramophone Company for selling the Scheme goods trade & for you to manage it on a compensations of 10% of the gross receipts from which % is to be deducted the expenses of this department, which should be very small. The Company to pass on credits & make prices, &c., & I think on account of the terms being so liberal you ought to assume a small % of the losses, should there be any. You to draw commissions as they are earned - on account of which you may draw \$100 - per week until such time (which I don't not anticipate) the Company may not consider itself warranted in continuing it.

I shall try and write you to-morrow a letter more in detail. If the conditions are not stated as you understood them, please 'phone me as I want them satisfactory to you, expecting your best efforts. Believing you can make a grand success.

Sincerely

Frank Seaman.

Wm. Newcomb, Esq.

CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York

In Equity

THE AMERICAN GRAPHOPHONE COMPANY, Complainant

vs.

NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN, Defendants

Sur Motion to withdraw Defendants' Record and Appearances
from Case.

AFFIDAVIT OF F. P. DIMAIO, JR.

City
COMMONWEALTH OF *Massachusetts*)
District of *Essex*) ss.
~~County of~~ *Worcester*

F. P. DIMAIO, JR., being duly affirmed, deposes and says;
that he is well acquainted with the Building #874 Broadway, New
York City, which is at the corner of 18th Street, and also with the
Grand Hotel Building at 1234 Broadway, New York City.

In the Building #874 Broadway, New York City, the hall direct-
ory contains the following:

3rd Floor

FRANK SEAMAN

NATIONAL

GRAMOPHONE

CO.

This sign occupies the whole slab of the hall directory which
is devoted to the third floor.

In the Grand Hotel Building The Universal Talking Machine
Company has a sale's room on the first floor, opening out on Broad-

way. The number of this store is 1234 Broadway. The rent of this store is paid by the National Gramophone Corporation, which uses its own check in making the payments.

Applicants at the store of The Universal Talking Machine Company #1234 Broadway for employment by that Company as agents are referred to the National Gramophone Corporation 874 Broadway, and are there told that Frank Seaman is the head of the National Gramophone Corporation and the head of The Universal Talking Machine Company,---the boss of the whole thing, and that the main offices are at 874 Broadway,---third floor, Frank Seaman's office.

AFFIRMED AND SUBSCRIBED)
before me this Second)
day of November, A. D. 1900.)

X. P. Duinais Jr.

Edmund J. Kees
Notary Public
D.C.

#\$/M#\$/C#\$/S#\$/

PHILADELPHIA COUNTY.)
) SS.
STATE OF PENNSYLVANIA.)

WILLIAM BARRY OWEN, being duly sworn, deposes
and says:

I am the Managing Director of the Gramophone Company, Limited, of London, and am temporarily residing in London, England. I was a director in the National Gramophone Company when it was organized and started business, and remained a director until about July 1, 1897. Mr. Seaman gave me one share of stock to qualify me as a director, and I returned this to him at his request when I resigned. When the National Gramophone Company was formed, Frank Seaman turned over to it all the good will of the gramophone business that he had, and all its assets and stock and trade to fully pay the capital stock of Fifty Thousand Dollars, and the Company assumed all his liability on account of the gramophone business to the extent of about Twenty-Two Thousand Dollars. Notes were given by the National Gramophone Company to Frank Seaman for the amount that he had expended. It was understood at the time that the good will which he turned in included all his right under the Berliner contract. He was not, however, at liberty under the terms of the contract to make a formal assignment of it without the consent of the Berliner Gramophone Company. He owned all the stock of the National Gramophone Company at the beginning, except such as he chose to give out to individuals qualified as directors. While I was a director of the National Gramophone Company, Seaman repeatedly proposed to me plans for the formation of a separate company for the purpose of taking a low priced machine and tak-

MARION C. SHAEFFER,
STENOGRAPHER
HARRISONBURG, VA.

ing some part of that machine and building another form of machine of the major parts of which he would refuse to pay a royalty to the Berliner Gramophone Co. The zonophone scheme is a practical developement of this plan. I refused to have any thing to do with it. X

As to the persons closely associated with Mr. Seaman, O. D. LaDow was hired by him about thirty days before I resigned as a director. To the best of my recollection, he was employed by Seaman at the rate of Forty Dollars a week.

F. J. Dunham, who is President of Dunham Cocanut Co., W. LeCato and George H. Robinson are connected with the Gorham Manufacturing Company and are all three intimate personal friends of Frank Seaman. Lillie H. Seaman is Frank Seaman's wife.

Miss Francis Crouch is Mr. Seaman's private Secretary, and while I was connected with the National Gramophone Company in New York, she was charged with the duty of opening all the mail addressed to the National Gramophone Company or Frank Seaman, and taking out all the money which the letters contained, so as to account for it. The National Gramophone Company contributed Ten Dollars weekly towards her salary for these services.

In November, 1899, I came to America for a short visit, and while at the Hotel Imperial in New York, F. M. Prescott of New York, in charge of the export trade of the National Gramophone Corporation and the Universal Talking Machine Company, came up to me in the corridor of the hotel, and on behalf of Seaman and LaDow asked me to call upon them for the purpose of arranging a combination between the London Gramophone Company and the New York interests, including X

any foreign patents controlled by the National Gramophone Company and the Universal Talking Machine Company, whereby the combination should undertake the sale of gramophones throughout the United States as well as England, irrespective of the contracts they might have with the Berliner Gramophone Company of Philadelphia or the United States Gramophone Company of Washington, meaning and saying that they had placed themselves in a position of being able to manufacture gramophones and gramophone records without the help of the Philadelphia or Washington Companies, and that they were prepared to undertake it without paying any royalties under such contracts. I indignantly refused to have anything to do with such a proposition. I returned to London the next morning. Afterwards, in London, I repeatedly received cablegrams from Frank Seaman or O. D. LaDow, (I think both signed telegrams to this effect, but I am not sure), indicating that it was entirely useless for me to purchase the Berliner and United States Companies. He assured me that, having received the contract from Easton for production under the gramophone patents, they were in such a strong position that it would be a waste of money to pay any thing to the Philadelphia and Washington Companies for their rights. This correspondence took place between my visit in November and the present time. In the course of business correspondence, the London Gramophone Company received a letter from Mr. LaDow and Mr. Seaman, dated 10 June, 1898, a copy of which is hereto annexed.

WM. BARRY OWEN.

Sworn to and subscribed before me, this 4th day of Aug., A. D. 1900.

E. St. Croix Oliver, .

(Notarial)
(Seal.)

Notary Public.

(Copy of letter dated June 10th, 1898, from the National Gramophone Company, New York, to Mr. Williams, London).

Dear Sir:--

We received yours of May 27th.

We admire your adriotness even if we cannot say so much for your memory. We look in vain for anything which you agree to do, provided we agree to permit you to manage a very fair proportion of our business; but we have no difficulty in finding on nearly every page evidences of faulty memory of what passed between us during the progress of the negotiations. We will take up and answer seriatim the various points of your communication.

We are sorry and more than surprised, to read that you suspect our good will and intention toward you, in that we have knowingly supplied machines and records for exportation. We say surprised, because we presume you refer to a shipment, the order for which was received while you and Mr. Owen were in this country. The matter was laid before Mr. Owen, and he distinctly and positively agreed that we should ship these goods, the profits from the sale of which to be shared with him, personally, in accordance with the original arrangement made with him. If any blame attaches to this shipment, put it where it belongs, and do not impugn our good will or intentions therefor.

With reference to the license to sell Gramophones from the Edison Company, we knew nothing of the matter until after the application had been made, but we will state that after Messrs. Peck & Co. had abundant authority to act for us outside of the United States for the sale of our goods, and they were under obligations to forward such sales as much as possible. They knew nothing of the proposed arrangement

with you. They acted in good faith, having been threatened by the Edison Company. You will absolve Messrs. Peck & Co. from any conspiracy against yourselves, so far as the injunction is concerned, when you are told that our information came from a gentleman connected with the Trans-Atlantic Service, who is a frequent visitor at our office.

With reference to the cablegram as to your dealings in France, it was dictated by the duly authorized representative of the National Gramophone Company, whose action is herein confirmed, and for which we become entirely responsible. Nor do we do your memory any credit when you affect to be surprised at this cablegram. You know very well that this whole matter was discussed between Mr. Williams and the writer several times, and notably at Yonkers. We stated decidedly then, as we do emphatically now, that the National Gramophone Company will protect its rights in France. It does not believe in, and has no respect for the alleged claims of the patentee in that country. We have told you over and over again that the claims of Mr. Berliner, in foreign countries, are practically worthless. We made this a point in our arguments as to the desirability of an amalgamation of interests. We do not propose to infringe on anybody's rights. We are not to be taken as wanting in respect and in regard for Mr. Berliner, in what we are saying. We do not propose to ask for more than what is justly our due under the conditions, but we do ~~not~~ propose to protect the business which we have built up in France as well as in some other places; and to this we pledge our capital and our best efforts. We proposed to do this in a peaceful way and that proposition was not only embodied in the conversation with you, but it was accepted by you outright. If you now forget all that you agreed to do, we do not.

You state your our attitude is ^{the} more accentuated because the action proposed naturally endangers the agreement which we hold with the Berliner Company of Philadelphia. We have no agreement with the Berliner Company, of Philadelphia, and are neither known to them, nor are they known to us, officially. This Company is independent of the agreement to which we presume you refer, nor are we dependent upon the product of that Company. We should be remiss in our duty had we failed to provide ourselves against the very weaknesses of the Berliner patent, as before alluded to. It is proper to say that we have so provided, and can place upon the foreign market, within a very short period, complete machines and records, which do not in any way conflict with the present patent, but which are in themselves, let us say, impregnable.

You affect surprise to find what Messrs. Peck & Co. have done in Paris, in the way of contracts, and chide us for having withheld knowledge of this contract from you when treating with you in their behalf. This is one of the many surprises of your communication. We not only told Mr. Owen of the details of this contract, but we outlined it in full to him, in so far as we were ourselves informed. We told him the number of machines which the Paris Agency had agreed to take, (at which he remarked that the number was too small in his opinion), and we gave him the name of the party to the contract; and yet you say that we withheld information from you, and that these facts have tended to shake your confidence in our intentions. Can you blame us, after having received the assurance from both yourself and Mr. Owen, that matters in France would receive your protection, for cabling you as we did, upon being informed of your going squarely back on your agreement, and of threatening to prosecute as well, those who had entered into contracts with us in good faith.

We did not cable, upon receipt of your letter, any one of the three words which meant (1), That we were willing to permit you to regulate our business. (2), That you were to have the exceptional privilege of ordering small quantities of goods at ridiculously low prices, and (3), That we did not care to have anything further to do with you after the thousand machines and fifty thousand records had been delivered. Under no consideration would the first two have been acceptable, nor did we wish to be misunderstood by cabling the third word. We have every desire to meet you upon fair and liberal grounds. We have quoted you prices which leave us a scant profit, in order to prove that we are friendly. These prices were quoted after you had intimated that you would be willing to have a union. Those prices were an evidence of good faith, on our part, to the transaction. The evidence of good faith on your part was your word. We have kept our part of the agreement. Can you say the same for yours? We told you distinctly, at the very outset of our negotiations, that this Company was determined to reap the benefit of its prestige in foreign countries; that there were two ways by which this could be done, the one by peaceable means, the other by force. You accepted the former, went home and turned about, cabling us as you did, that you had no proposition to offer. Are you ingenuous when you affect surprise at finding us in an attitude of using the only alternative which is left us, without ~~we~~ abdicate altogether and leave you handsome profits which legitimately belong to us.

To sum up this somewhat hastily prepared letter, we would say that you can do business with us when you conclude that there is some equity on our side in this case. We do not ask for more consideration than is our due, under all the circumstances, some of which may still be unknown to you, Mr. Williams. There is no personal feeling in this matter.

The duties of the officers of this Company are to obey the mandates of its Board of Directors. That mandate is emphatic and absolute, that the foreign interests of this Company shall be defended against all attacks.

When you in London tell our friends that New York is only a branch house of your Company; when you notify customers of ours, who wish to buy for countries outside of your alleged jurisdiction that you will proceed against them if they buy from us direct; when you apparently make it a point to antagonize and embarrass us with our patrons, we do not feel that it is becoming in you to talk about unfair treatment when you find that we are defending ourselves. We are always ready to treat you generously and in the most liberal spirit.

We will finish your contract when you arrange for the payment of your goods thereunder, on this side. No other agreement will be satisfactory. After that order shall have been completed, if you desire to negotiate further, we shall be pleased to consider your favours. If, on the contrary, you think that you can get along without the co-operation and support and friendship of the National Gramophone Company, it is your right so to think and to act. Certain it is that, if you choose to take such a course, you do it with your eyes open, after what we have said to you and written herein.

Very respectfully,

National Gramophone Co.,

O. D. LaDow,

Secretary.

The following added in writing by Mr. Seaman:-

Dear Mr. Williams:--

I am just back to the City, and have only

a moment to say, apropos of the enclosed that I am personally very sorry that you did not see fit to carry out the Yonkers agreement. Had you done so, all would now have been serene, you would be getting your goods at only a slight advance over the actual cost, there would have been no occasion for all this correspondence, and all would have been well along the line.

Faithfully yours,

FRANK SEAMAN.

Copy S.

A Copy.

Teste:

A K Fletcher Clerk.

State of New York

City of New York. s.s.

vs.

) N.Y.

) In Equity

NATIONAL GRAMOPHONE COMPANY and

FRANK S. SEAMAN

Defendants

Joseph W. Jones, being duly sworn according to law, deposes and says as follows:

That he is a resident of the City of New York, residing at #48 Irving Place, Borough of Manhattan, and is engaged in manufacturing specialities at #344 Bowery, New York City.

That he is and has been for a long time past acquainted with Frank Seaman and Orville D. LaDow. That this deponent in April and May 1898 frequently visited the office of Philip Mauro, especially for the purpose of transacting certain business with Mr. Chas. A. Massey, who has an office with Mr. Mauro and is associated with him in his law practice.

That this deponent is familiar with the fact that a suit is pending in the United States Circuit Court for the So. District of New York brought by the American Graphophone Co. against the National Gramophone Co. and Frank Seaman, and on or about May 7th or 8th, 1900, he was informed that a consent decree had been entered by the National Gramophone Co. (one of the defendants in said suit) admitting the validity of the Graphophone Company's patents, etc.

This deponent further states that a few days prior to the date of the entry of the decree in said case, he was in Mr. Mauro's office on the thirteenth floor of #137 Broadway, New York City, in consultation with Mr. Massey, and that while there he saw Mr. Frank Seaman and Mr. LaDow leaving Mr. Mauro's private office. When this deponent first heard that such consent decree had been entered by the National Gramophone Co., he at once recalled this fact that he had seen Mr. Seaman and Mr. LaDow in Mr. Mauro's office on the date or prior to the date of the said consent decree.

Sworn to before me this

2^d day of Nov., 1900..

Geo. W. Dwyer
Notary Public
N.Y.C.

Joseph W. Jones

For the Southern District of New York.

In Equity.

VS.

Sur Motion to withdraw Defendants' Record and
Appearances from Case.

AFFIDAVIT OF CHARLES H. BARTLETT

Commonwealth of Pennsylvania,)
)ss.
City and County of Philadelphia.)

Charles H. Bartlett, being duly sworn according to law, deposes and says as follows:- From September 1898, to May, 1900, I was employed by the National Gramophone Company and the National Gramophone Corporation, its successor, as a stenographer and type-writer at 874 Broadway, third floor of the McIntyre Building. The National Gramophone Corporation was organized about March, 1899, and from that time until May, 1900, I was paid by the said corporation. Prior to that time I was

paid by the National Gramophone Company. Although I received my salary from the said concerns I also did work for Frank Seaman personally, which was assumed to be and which I considered part of my business, and frequently attended to the writing of Mr. Frank Seaman's letters in connection with his advertising business, which was his general business and also personal correspondence of the said Seaman. The front portion of the third floor ~~xxxxxx~~ was divided by low partitions into three separate offices, the central portion, or portion back of these partitions, was used as the general office of the National Gramophone Company, back of this a portion was railed for the book-keepers, and back of this railed-off portion another portion was railed off occupied by the clerks of Mr. Frank Seaman employed to attend to his general advertising business, and the balance of the rear portion of this floor was used as the wholesale department of the National Gramophone Company and the National Gramophone Corporation, its successors. The larger office in the front of the building, of the three hereinbefore referred to divided by low partitions, was occupied by Mr. Frank Seaman as his main office where he conducted his general advertising business, and communicated with the general office ^{the} of the National Gramophone. Mr. O. D. LaDow occupied a smaller front office divided by a low partition from Mr. Seaman's office, having a door communicating with Mr. Seaman's office; a small office to the rear of Mr. LaDow's was occupied by

Mr.W.T.Hepper, assistant manager of the National Gramophone Company, communicating with Mr.LaDow's office, and communicating with the general office. When I first was employed here I occupied a desk in Mr.Hepper's office, and shortly afterwards my desk was placed in the general office. For the purpose of performing my duties as stenographer and type-writer I was supplied with stationery having the heading of the National Gramophone Company thereon, another set of stationery having Frank Seaman's name thereon, being his letters heads with his advertising agency noted thereon, and subsequently, after the organization of the universal Talking Machine Company, I was supplied with a third set of stationery, being the letter heads of the Universal Talking Machine Company. Mr.Seaman dictated to me such letters as I had to write for him in his own general advertising business and personal matters; these I would write on the letter heads containing his name and advertising agency, which I kept separately in my desk, and Mr.LaDow or Mr.Hepper would usually dictate to me the letters concerning the National Gramophone company's business, which I would write upon the National Gramophone company's paper, which I also kept separately in my desk for this purpose, and as a rule Mr.LaDow would dictate the letters to me relating to the Universal Talking Machine company's business, which I would write upon the letters heads of this company, which I also kept separately in my desk for the purpose.

It was always understood by me, and by the clerks of the office generally, that Mr. Seaman was the moving and leading spirit of the National Gramophone company, and Corporation, and that he was the general head ~~xx~~ of the business and guided and controlled the general policy of the business. That Mr. Seaman employed also relative to his general advertising business a book-keeper, a clerk and a boy, who occupied the small railed-off portion used for this purpose, hereinbefore referred to ^{to} the rear of the general office, and in order to reach Mr. Seaman's office in the front these employees were obliged to pass through the central general office, as would also Mr. Seaman in going from his private office, where he conducted his general advertising business, to the said railed-off portion in the rear.

Chas. H. Bartlett

Sworn and subscribed before me this ninth day of
November, 1900.

Charles W. Friedman
Notary Public

CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York.

-----÷
The American Graphophone Company, ÷

Complainant, ÷

--VS--

National Gramophone Company and Frank ÷

Seaman, ÷

Defendants, ÷

÷ In Equity.
÷

-----÷
PLEASE TAKE NOTICE that on Friday, the 7th. day of
December, A. D. 1900, at the opening of Court on that
day, or as soon thereafter as Counsel can be heard, at
the Court Rooms of said Court in the Post Office Building
in the City of New York, we shall present to the Court the
petition, a copy of which is herewith served upon you, and
move for an order granting the relief therein prayed and
in support of said motion and of said petition shall read
the affidavits, copies of which are also served upon you
herewith.

Berliner Gramophone Company,

By

Horace Pettit,

Horace W. Hayes,

Of Counsel with Complainant.

To

R. N. Dyer, Esq.

Complainant's Solicitor

and Frank Seaman,

Defendant.

CIRCUIT COURT OF THE UNITED STATES
Southern District of New York.

AMERICAN GRAPHOPHONE CO.

VS.

IN EQUITY.

NATIONAL GRAMOPHONE CO.
AND FRANK SEAMAN.

AFFIDAVIT OF PHILIP MAURO.

COUNTY AND STATE OF NEW YORK, SS.:

PHILIP MAURO, being duly sworn deposes and says:
I am of counsel for complainant and am familiar with the
proceedings herein.

This suit was instituted to determine whether the
machine manufactured and put out by the Berliner Gramophone
Co. and the U. S. Gramophone Co. is an infringement of cer-
tain claims of complainant's patents. Said companies are
the real defendants and parties in interest; and have been
from the first, and are now, in complete control of the
defense. They own the patents under which defendants' product
is manufactured.

At the time the suit was brought the nominal defen-
dants were engaged in selling, within this jurisdiction, the
product of the real defendants, Mr. Frank Seaman being the
selling agent for the latter under a written contract, as
appears from the motion papers, and the National Gramophone
Company being a dealer, purchasing its supplies from said
Seaman.

The petition and supporting papers contain voluminous
recitals of alleged grievances of the petitioners against t
their selling agent, alleged violations of said contract, and
other matters having no bearing at all upon the good faith
or fairness of complainant in prosecuting this action.

The only pertinent allegation is that a conspiracy has been entered into between complainant and the nominal defendant, Seaman, to defraud the real defendants and to defeat them in this action; and the Court is asked for an order that the answer filed and proofs taken by defendants may be withdrawn from the case. The allegation of conspiracy is the one with which I have to deal. It is unqualifiedly false. I further state that, upon petitioners own showing, there is no possibility of the existence of any conspiracy. Upon their showing the defense is, and has always been, absolutely in the hands of their counsel, who have conducted the case at every stage. It would be physically impossible for the nominal defendant to interfere, or in any manner act to their prejudice, even if disposed so to do. The only issue in the case is whether or not complainant's patents cover the machine whereof these petitioners are the sole proprietors. Upon that issue voluminous proofs have been taken, and defendants have here every opportunity for a full presentation of their case that they could have anywhere.

The claims involved have been construed by this Court at final hearing, and the patent in suit is very familiar to the Judges of this Circuit having been many times before them. It is manifest that the points in litigation can be most effectively and promptly disposed of by this Court, which has full jurisdiction of the controversy.

The patent has but two years and five months of remaining life. It has been evident for a long time that defendants' aim is to protract the litigation to the end of its term if possible. Long after knowledge of the events recited in the supporting papers, to wit, in October, 1900, defendants appeared in this Court opposing a motion to limit their time, and demanded six months in addition to the year already consumed by them. They then declared their intention to take

further proofs.

Only after their time was limited by the Court, was
the present petition brought.

Sworn to before me, this

6th day of December, 1900.

Philip Mauro

:
:
:

Richard S. Murphy
Notary Public
N.Y.C.

CIRCUIT COURT OF THE UNITED STATES,
For the Southern District of New York.

-----X
The American Gramophone Company, :
Complainant, :
-vs- :
National Gramophone Company and :
Frank Seaman, :
Defendants. :
-----X

State of New York,)
: ss:
City and County of New York.)

FRANK SEAMAN, being duly sworn, says: I am
the defendant in the above entitled cause.

Late yesterday afternoon, December 6th, 1900,
a copy of the Petition and Notice of Motion to withdraw
the answer and proofs herein were served on me.

It is alleged in said Petition that I have con-
spired with complainant to defend the petitioners and preju-
dice them in this case. This statement is totally untrue.

My acts complained of in the Bill of Complaint
herein as infringements of complainant's patents, were all
done as the exclusive licensee of the Berliner Gramophone
Company, one of the petitioners under a written contract
referred to in the affidavit of Thomas S. Parvin.

This contract, among other things, obligates
the Berliner Gramophone Company to defend me and save me
harmless if, in consequence of my selling or using machines
and other articles made by the Berliner Gramophone Company,
any infringement suit should be brought against me. The

terms of said contract in that regard are as follows:-

"The licensor shall defend, at its own cost
"and expense whenever requested by the licensee, all actions
"and suits involving the validity of any of the patents
"hereinbefore mentioned, or of any other patents which may
"be issued for improvements in the said inventions and may
"become subject to this agreement."

As soon as this suit was brought, the defense thereof was placed in the hands of the Berliner Gramophone Company and the United States Gramophone Company and their Counsel, and has been absolutely in their control.

I have not had, at any time, nor have I now, anything whatever to do with the management or conduct of the case.

I am not represented in it by Counsel nor have I so been, except so far as I am represented by the Counsel employed and paid by the above named Companies.

I protest against the granting of permission to the petitioners to violate their contract with me by abandoning the defense of this case, unless I be absolutely relieved and discharged therefrom, and from all liability thereunder.

The statements contained in the moving papers are the petitioner's version of differences that have arisen between us and which are the subject of litigation in another cause in another Circuit.

I could only refer to these differences in detail by bringing in the record in that case. These statements have all been passed upon by the Court having jurisdiction of the controversy, and the petitioners have been

enjoined from violating their contract with me, as they
sought to do, by selling gramophones and gramophone goods
to and through other persons.

Sworn this 7th day of
December, 1900, before me.)

Frank Ramsey

Frank Cochran
Notary Public, 1160
New York County

U. S. CIRCUIT COURT,
S. D. N. Y.

AMERICAN GRAPHOPHONE CO.

VS.

NATIONAL GRAMOPHONE CO.
and FRANK SEAMAN.

SUPPLEMENTAL MEMORANDUM IN
OPPOSITION TO PETITION.

PHILIP MAURO,
of counsel for complainant.

UNITED STATES CIRCUIT COURT
Southern District of New York.

AMERICAN GRAPHOPHONE CO.

VS.

IN EQUITY.

NATIONAL GRAMOPHONE CO.
and FRANK SEAMAN.

HON. E. HENRY LACOMBE,
U. S. Circuit Judge,

Sir:-

In view of the fact that, upon yesterday's hearing of the petition in the above matter, the controversy between the nominal defendant Seaman and the petitioners (U. S. Gramophone Co. and Berliner Gramophone Co.) together with the contentions made on behalf of the said defendant Seaman were given such prominence that it was not feasible to present the claims of the complainant as fully as would otherwise have been done, and that fraud had been directly charged against said complainant; and in further view of the exceedingly great injury that would result to this complainant should the petitioners be allowed to withhold the testimony already taken but not filed,—it is respectfully requested that your Honor will consider the following

MEMORANDUM.

The petitioners asked to withdraw the appearance of the gentlemen who have been acting as counsel for the defense; to withdraw the Answer now on file; and for an order, or leave, to withhold filing the testimony already taken. This testimony, it may be stated, was taken in the District of Columbia before a special examiner by consent, under Equity Rule 67.

Of course complainant cannot insist upon the gentlemen continuing to act as counsel for the defense, and your Honor stated from the bench that the Answer already filed could not be withdrawn. There remains to be considered the matter of withholding the testimony taken on behalf of the defense before the occurrence of the acts which petitioners now complain of as constituting fraud and collusion, and which therefore, even by their own showing, cannot be tainted by such alleged improper conduct.

Mr. Mauro has already pointed out orally that the obvious purpose of these proceedings on behalf of the petitioners is to protract matters until the expiration of complainant's patent. Should the depositions taken on behalf of the defense be withheld, and the complainant thereafter obtain a decree by default, such decree would be absolutely worthless, not only against these petitioners--the real defendants--on the ground that they were no longer privy to the defense here, but for any purpose, since the complainant's standing as to said decree would always be tainted by the imputation of fraud. The direct charge of fraud is made here, in proceedings now pending before this Court and as to matters over which this Court has jurisdiction; the petitioners seek to bring it about that we would have to meet such a serious charge, not here where the facts occurred and the charge originated, but in another circuit. The matter seems of so grave a nature that it warrants requesting your Honor's consideration of the authorities noted below.

A DEPOSITION IS NOT UNDER CONTROL OF THE PARTY ON WHOSE BEHALF IT IS TAKEN; BUT THE EXAMINER BEFORE WHOM IT IS TAKEN IS pro hac vice REPRESENTING THE COURT, AND ACCORDINGLY THIS COURT IS ALREADY IN CONSTRUCTIVE CONTROL OF THE DEPOSITIONS EVEN BEFORE THEY ARE FILED IN THE CLERK'S OFFICE.

"Transmission of deposition.---When the examination of witnesses before the examiner is concluded, the original depositions, authenticated by the signature of the examiner, SHALL be transmitted by him to the Clerk of the Court, to be there filed of record in the same mode as prescribed in section 865 of the Revised Statutes."

Part of Equity Rule 67,--Desty's Fed. Pro., 9th Edition, Vol. 3., page 1784.

it is to be noted that this rule is mandatory--the depositions shall be transmitted."

"When the parties to an Equity case stipulate that testimony may be taken before any officer or magistrate qualified to administer oath without special appointment by the Court as an examiner, the depositions thus taken must be filed of record, as required by U. S. Equity Rule 67 in cases where an examiner is regularly appointed; and a party in whose behalf the testimony was taken has no right to suppress it."

Beach, Mod. Eq. Prac., Vol. 1, page 551, Sect. 544, and foot note.

The foregoing quotation from Beach is on all fours with the facts at bar. The attention of the Court is particularly invited to the foot note (6) in the text, the same being a lengthy extract from Mott Iron Works vs. Standard Mfg. Co., 48 Fed. Rep., 345; which passage refers to numerous other decisions to the effect that in such a case the deposition is not in control of the party on whose behalf it was taken, but that the examiner is pro hac vice representing the Court, and that the testimony is therefore already in control of the Court and cannot be withheld. The examiner has no discretion in the matter, his duty is merely to authenticate the depositions as evidence, and he is then bound ("shall", "must") transmit the same to the Clerk of the Court.

If it is permissible to do so, it is earnestly requested that your Honor will pass expressly upon the question of fraud and collusion and conspiracy as charged against this complainant; and, unless your Honor is satisfied that these charges are made out, that you will explicitly refuse permission to withhold the depositions taken on behalf of the defense (under the authorities above noted),—instead of confining your decision to an order merely allowing the gentlemen to withdraw their appearances.

Dated December 8, 1900.

Respectfully submitted

Philip Mauro
C. A. Massie
Of Counsel for Complainant.

A copy of this memorandum is this day transmitted to our adversaries.

Re

American Graphophone Company vs. National
Gramophone Company et al.

In re

TESTIMONY OF WITNESSES ABROAD who invented, operated or had knowledge of machines or records for recording sound by use of lampblock, stearine or waxy or other substance, and made reproductions therefrom or from records formed from electrotpe plates etc; and whose inventions or devices were described in publications abroad or in this country prior to the date of Bell & Taintor's inventions (1885)

M. Lambrigot, of Albi, in the Department of Tarn, south of France, an inspector of Telegraphs at Albi, Department of Tarn, about latter part of 1878 and early 1879. A clear description of Lambrigot's invention is to be found in "Enginerring" - published at London, England, April 18th, 1879 - Vol. 27 page 326 etc.

M. Dumoncel, of Paris, also describes M. Lambrigot's invention as follows in Le Telephone, Le Microphone and La Phonograph by Du Moncel, Paris, 1880, page 366, I quote the description.

Lately Mr. Lambrigot, an officer of the administration of telegraph lines.... showed me a system of phonograph, contrived by him, and which has been reduced to its most simple form.

"Here is a description of the process M. Lambrigot as he has sent it to me: The apparatus consists of a flat piece of wood set up vertically on a base, and fastened solidly. At the center of this flat piece of wood, is a round hole, covered over with a sheet of well stretched parchment, against which bears a steel knife which should, like the point of the phonograph, trace the vibrations. A solid piece rises from the base to the center of the flat piece of wood, and supports a slide,

which permits a car to move round before this flat piece of wood. On this car is a rod of glass, one of the faces of which is covered over with stearine. By approaching the car, and causing it to go back and forth, the stearine comes into contact with the knife and takes its form regularly, which is semi-cylindrical, the whole of its length. When a sound is heard, the sheet of parchment is put into vibration and communicates its movement to the knife which penetrates into the stearine and traces varied lines.

"The reproduction thus obtained on the rod of glass is subjected to the ordinary processes of metallization. By galvanization a deposit of copper is obtained which reproduces the lines in an inverse sense. When it is desired to cause the metallic sheet to talk, it suffices to pass lightly over the signs ~~ap~~ point of wood, of ivory or of horn, and by moving it along more or less quickly, diverse intonations can be heard without altering the pronuniation.

.....
He has found means, by a process extremely simple, to imprint strongly in the interior of a small trench of copper, the vibrations determined by the voice, and they are so cleanly engraved that by passing them across the dulled point of a match, entire phrases can be heard

Suggest Mr. Clark find Mr. Lambrigt, or some of his family or persons at Ten, France, who had seen invention Also M.DuMoncel, of Paris.

Mr. Charles Cros -

Mr. Charles Cros most probably resided in Paris, France, April 30th, 1877 - on that date he sent under sealed cover, to the Academy of Science of Paris, a description of his invention, which is fully described in

Compter Rendus (article on Cros. Phonograph)
issued December, 1877 - (Paris) pg. 1082-3.

Also described in Mr. Cros:

French Patent, delivered July 27th, 1878 No. 124,213.
Mr. Leblanc - (the Abbé Lenoir) of Paris at that time (1877) may have knowledge of the invention.

Mr. Cros in his French Patent states that before December 1877, he had Mr. Lebman (abbe Lenoir) publish an article on it, in the "Semaine du Clérge," a Paris publication.

Mr. Victor Meunier also is thanked by Mr. Cros in his

French Patent for "his bright articles" on the in Raymond R. Wile Research Library

Mr. Meunier was probably also of Paris, in December 1877 as he on December 11th, 1877 published an article in "Le Rappel" (Paris) on the "Cros Phonograph". Members of the Academy of Science in December 1877 may also have had knowledge of the invention. The article most descriptive of the Cros machine is the "Comptes Rendus", referred to; the Patent refers particularly to the records.

Did Mr. Gros ever operate a machine or make records as described in the Comptes Rendus, or in his French Patent Suggest Mr. Clark arrange to find if possible for this information:-

Mr. Charles Gros, or some of his family.

Mr. Leblanc (Abbé Lenoir)

Mr. Victor Meunier

Members of the Academy of Science-Paris of December 1877 etc.

.....

Abbé Carbonel,-

Abbé Carbonel, a professor at the Belsunce school, Marseilles, France. There in 1878, or early 1879. His invention is described in "The Telegraphic Journal and Electrical Review" January, December, 1879, published in London, Eng. page 53. He calls it a phonograph, and states he used a band coated with wax to take the impression, and also albumen spread on paper or other base instead of wax applied to copper, and states that the soft albumen base is afterward hardened in a well known manner, and a hard matrix, whose dints vary in depth with the intensity of the sound, is obtained.

As a means of reproducing sound he suggested a Savarts wheel, instead of a vibrating plate.

Whether the Abbe Carbonel even made a record or reproduced sound in the method described by him could be ascertained perhaps readily by inquiring at Belsunce School, Merseilles, thus getting track of the Abbé, or if dead, the information perhaps could be had from those in the school, or in Marseilles who knew him and of his work.

"Les Mondes", of September - December 1878, Vol. 47 published in France, pages 590,591, publishes an article on Abbé Carbonel's invention, by the Abbe Moigno. The Abbe Moigno, if found, may have knowledge of experiments and demonstrations of the Abbe Carbonel's invention.

.....

Also testimony from Cleveland Walcott, now in Paris- as to the inoperativeness and worthlessness of the graphophone which was built as illustrated and described in the Bell & Tainter Patent #341,214.

And all the other information which can be obtained relative to the matter.

AMERICAN GRAPHOPHONE CO. v. NATIONAL GRAMOPHONE CO. et al.

(Circuit Court, S. D. New York. December 11, 1900.)

PATENTS—SUIT FOR INFRINGEMENT—WITHDRAWAL OF DEFENSE.

One who is not a party to a suit for infringement, but has become privy to it by assuming the defense under an agreement to protect the defendant, may withdraw from the prosecution of the defense, and the appearance entered for defendant by its counsel, at any time; but pleadings and evidence already on file or in the hands of officers of the court, whether examiner, master, or clerk, cannot be withdrawn.

Petition of the Berliner Gramophone Company and the United States Gramophone Company to withdraw answer and testimony introduced by it on behalf of the defendant Seaman, under contract to defend.

The bill in equity in this case was filed December, 1898, to restrain the defendants from infringing letters patent of the complainant Nos. 341,214, issued May 4, 1886, to Bell and Tainter; 341,288, issued May 4, 1886, to Sumner Tainter; 375,579, issued December 27, 1887, to Charles Sumner Tainter, —all being for improvements relating to graphophones. An answer on behalf of the defendants was filed shortly thereafter by counsel retained by the Berliner Gramophone Company, which was not a party defendant. At the time of the filing of the bill of complaint, Frank Seaman, one of the defendants, had a contract with said Berliner Gramophone Company by which the said Seaman was made the sole selling agent of the said Berliner Gramophone Company, and by which contract it was obligated to defend the said Seaman in any suits for infringements which might be brought against him by reason of his selling the gramophones and gramophone goods of the Berliner Gramophone Company. The Berliner Gramophone Company, in co-operation with the United States Gramophone Company, its licensor, thereupon undertook and carried on the defense of the said suit against the said Seaman by its own counsel, at its own expense. On or about the 5th day of May, 1900, a consent decree, without the knowledge of the Berliner Gramophone Company, was entered by the National Gramophone Company with the connivance and knowledge of the said Seaman, as alleged by the petitioners, for the purpose alleged, of injuring the business of the Berliner Gramophone Company. After the date of the said consent decree no further testimony was taken by the said Berliner Gramophone Company on behalf of the defendants. On July 26, 1900, the Berliner Gramophone Company notified the said Frank Seaman of the termination of its contract with him, by reason of certain alleged breaches on the part of the said Seaman; and about this time the said Seaman instituted suit in the United States circuit court for the Western district of Virginia to restrain the Berliner Gramophone Company from terminating its contract. On October 19, 1900, the American Graphophone Company secured an order limiting the time of the defendant Seaman for completing his testimony; and on November 16, 1900, the Berliner Gramophone Company and the United States Gramophone Company, the petitioners in this motion, presented their petition praying for leave to withhold all testimony from the case taken by it at its expense on behalf of the defendant Seaman, and to withdraw the answer filed, and also the appearances of its counsel which had been entered for the defendant Seaman. The defendants' testimony taken before a notary had not been filed in the office of the clerk of the court. For former opinion, see 90 Fed. 824.

Philip Mauro and C. A. L. Massie, for complainant.

Horace Pettit, Howard W. Hayes, and Charles E. Mitchell, for petitioners.

Waldo G. Morse, for defendant Seaman.

LACOMBE, Circuit Judge. The situation in this case is as follows: The plaintiff contends that both defendants infringe its patents. The defendant Seaman has or had a contract with the Berliner Gramophone Company, under which they undertook to defend him, should he be sued for infringement because of his handling the instruments of the Berliner Company. This latter company therefore entered upon the defense of this case in behalf of Seaman, and has taken considerable testimony. Recently the defendant National Gramophone Company has conceded infringement, and allowed a decree to be entered against it. Moreover, quarrels have arisen between Seaman and the Berliner Company, and their relations are greatly strained. Under these circumstances the Berliner Company (which never was made a party to the suit) desires to withdraw from the further prosecution of the defense, in order that the final adjudication in this suit may not have the effect in other litigations of a decision against a privy who had the opportunity to defend, and who did defend. To this there can be no possible objection. Indeed, it was wholly unnecessary to apply to the court for leave to withdraw from the prosecution of Seaman's defense; it being a matter entirely betwixt the Berliner Company and himself. Nevertheless it was perhaps desirable for the Berliner Company to make it thus a matter of record, so that their position in the future litigation between the parties to the suit might not be misunderstood. It further asks leave to withdraw the answer now on file, and the proofs presented by the petitioner, and that petitioner's counsel, who have appeared for said defendant Seaman, may be allowed to withdraw such appearances. As to the withdrawal of appearances of counsel, the application is granted, with the proviso that such withdrawal be not operative until 10 days from the date of the entry of this order, so that opportunity may be afforded to Mr. Seaman to retain other counsel to appear for him. Documents already on file, however, or in the hands of officers of the court, whether examiner, master, or clerk, may not be withdrawn from the files. Therefore the motion as to the answer and as to any proofs that have been filed is denied. As to the proofs which have been taken in the case, but have not yet come within the custody of the court, this court has nothing to do with them. Withdrawing, as they do, from the case, the Berliner Company, and the counsel with which it supplied Mr. Seaman, are under no obligation to file anything which they have not yet filed. Much of the testimony, however, it may be supposed, has been taken down stenographically, and transcript written out for both sides. What shall be done touching this testimony—whether it shall be, by assent of both parties to the continuing litigation, hereafter filed as a part of the defendant's testimony, or whether it shall become the subject of some motion by one side or the other—is a matter which the court is not now called upon to decide. Certainly it has no power to require the complainant to deliver up to the Berliner Company the transcripts of the testimony which the complainant already has, or to assent to their destruction.

CIRCUIT COURT OF THE UNITED STATES

For the Southern District of New York.

In Equity.

The American Graphophone Company,
Complainant,

vs.

National Gramophone Company, and Frank Seaman,
Defendants.

N O T I C E.

Please take notice that on Friday, the 21st, of December, 1900, at the opening of Court, or as soon thereafter as the matter may be heard, Counsel for Petitioners in the matter of the Petition filed and heard December 7th, 1900, will present to the Court sitting in Post Office Building, City of New York, New York, the annexed order drawn in accordance with the decision of the Court rendered since the hearing, for the Court's signature. At which time and place you are invited to be present.

Yours very truly,

John P. ...
Of Counsel for Petitioners.

December 18, 1900.

Service of above notice and annexed order is hereby
acknowledged this ^{19th} day of December, 1900.

Philip Morris, Jr.
Of Counsel for Court.

Walter H. Morse

— appearing specially Of Counsel for Seaman.

CIRCUIT COURT OF THE UNITED STATES,
For the Southern District of New York.

In Equity.

The American Graphophone Company,
Complainant,

vs.

National Gramophone Company, and Frank Seaman,
Defendants.

O R D E R.

This cause coming on to be heard upon Petition of the United States Gramophone Company and the Berliner Gramophone Company, heard in open Court on December 7th, 1900, to withhold the filing of depositions already taken on behalf of the defendants, but not yet filed and to withdraw Answer, and appearances of Counsel of record for the defendant Frank Seaman; and now after hearing Howard W. Hayes, Esq., and Horace Pettit, Esq., on behalf of Petitioners, and Waldo G. Morse, Esq., appearing especially on behalf of Frank Seaman, one of the defendants, and Philip Mauro, Esq., on behalf of Complainant, the said

Petition and affidavits and exhibits attached having been duly filed in Court December 7th, 1900; and the Decision of Hon. E. Henry Lacombe, Circuit Judge, having been duly filed since the said hearing, it is in accordance with the said decision, upon motion of Counsel for Petitioners, this day ordered, as follows:--

1. That the Answer, which has already been filed *and any depositions or other documents which are on file or in the hands of officers of the Court, whether Examiner, Master or clerk* shall remain on file as part of the records of the Court, and shall not be withdrawn therefrom.

2. That the Petitioners have leave to withhold and to withdraw the Depositions of Mr. Joseph Lyons of Washington, D.C., which have been taken but not yet been filed.

3. That the attorneys now appearing of record as Solicitors and of Counsel for the said Frank Seaman, one of the defendants herein, may withdraw their appearances as aforesaid, any time after the expiration of ten days from the date of this order.

December 22 1900.

E. Henry Lacombe
U.S. Cj.

At a Special Term of the
Circuit Court of the United States
for the Southern District of New
York, held in the Court room thereof
in the Post Office Building in the
City of New York, this day
of December, 1900,

PRESENT:

HON. E. HENRY LACOMBE,

U. S. C. J.

AMERICAN GRAPHOPHONE CO.

VS.

IN EQUITY.

NATIONAL GRAMOPHONE CO.
and FRANK SEAMAN.

O R D E R.

This cause coming on to be heard upon the petition
of United States Gramophone Co. and Berliner Gramophone Co.
to withdraw the appearances of counsel for the defense as
well as the Answer and depositions filed on behalf of the
defense and to withhold filing depositions already taken
on behalf of the defense but not yet filed; and now after
hearing HORACE PETTIT, ESQ., and HOWARD W. HAYES, ESQ., on
behalf of the petitioners, and WALDO G. MORSE, ESQ.,
appearing specially on behalf of Frank Seaman the only
remaining defendant, and PHILIP MAURO, ESQ., on behalf of
the complainant; and after due deliberation and the Court
being fully advised in the premises, it is this day, upon
motion of ELISHA K. CAMP, ESQ., Solicitor for Complainant,
ORDERED as follows:

1. That the Answer and any and all other matters
or things heretofore filed herein must remain on file as
part of the records of this Court, and may not be withdrawn
therefrom;

2. That, as to the deposition of Mr. Joseph Lyons heretofore taken and concluded before Gustave Dittmar, Esq., in the City of Washington, D. C., acting as Special Examiner by consent,-- the said deposition shall be duly authenticated by the said Examiner and by him transmitted to the Clerk of this Court for filing, and the same shall be duly filed herein as constituting part of the records of this Court;

3. And that, upon compliance with the requirement of the preceding paragraph hereof, and at any time subsequent to ten (10) days after the entry of this order, the gentlemen now appearing of record as solicitors and of counsel for the defense, shall have leave, as requested, to withdraw their appearances as aforesaid.

IN THE CIRCUIT COURT FOR THE UNITED STATES,
FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY)

vs.)

NATIONAL GRAMOPHONE COMPANY,)

and FRANK SEAMAN.)

IN EQUITY.

NOTICE.

Mr. Philip Mauro,

#620 F., Street, Washington, D.C.

Dear Sir,

Please take notice that on Friday, March 15th, at 11 A.M., or as soon thereafter as counsel can be heard, at the rooms of the Court, in the Post-Office Building New York City, we shall call up the annexed motion for argument. At that time the affidavit of Gustav Bissing, hereunto annexed, will be read as part of the moving papers.

Yours respectfully,

Gustav Bissing

Counsel for Defendant.

Service of the above notice acknowledged this
day of *11th March* 1901.

Philip Mauro
for Compter

IN THE CIRCUIT COURT FOR THE UNITED STATES.
FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY)
)
 vs.)
)
 NATIONAL GRAMOPHONE COMPANY,)
) IN EQUITY.
 and FRANK SEAMAN.)

City of Washington,) ss.
District of Columbia,)

GUSTAV BISSING being duly sworn deposes that he is of counsel for Defendant in the above entitled cause.

On October 22nd 1900, the Complainant examined, under the provisions of Sections 863, 864 and 865 of the Revised Statutes, as one of their witnesses, Dr. Chichester A. Bell a resident of Richmond Surrey England, and one of the coinventors of one of the patents in suit. A copy of Dr. Bell's testimony is annexed to and forms a part of this affidavit. The witness was examined during the time allotted to defendants for taking their proofs which time did not expire until about December 15, 1900.

The testimony in this case shows that Bell and Tainter, the joint patentees of the patent in suit claim to be the originators of the vertically undulating cut wax records. Emile Berliner, of Washington, D.C., under whose patents the defendants is operating, claims to be the originator of the laterally undulating, etched or engraved record.

Again the defendants insists, that Bell & Tainter have merely invented a universal joint for sound reproducing in-

struments as an adjunct to a screw feed, which screw feed propels the reproducing instrument across the record composed of a multiplicity of grooves and which universal joint merely adjusts the reproducing stylus with reference to and within a single one of the many record grooves. The defendant further insists that Berliner was the first to dispense with the screw feed and to use a universal joint of such a character that the record groove propels the reproducing stylus across the record composed of a multiplicity of grooves and so that there is no adjustment of the reproducing stylus with reference to or within a single record groove, all as the Berliner patents show and describe. This independence of invention, as a matter of historical fact, is relied on by the defense as showing independence of invention as a matter of law. That the point, if established, would have great force, seems to be the opinion of complainant, for in its opening case considerable of its testimony was directed to showing, by way of forestalling the defense, that the Berliner inventions, were, as a matter of fact, old in the prior art,

The testimony of Dr. Chichester Bell attempts to make out that the laterally undulating etched record was invented by Bell & Tainter prior to Berliner. It further attempts to show that the freely swinging reproducer, which is not moved by a screw-feed, but which is propelled across the entire record by the record grooves themselves, was also invented by Bell & Tainter prior to Berliner.

The Complainant, in fact, attempts to show that the laterally undulating etched record and the freely mounted record-propelled reproducer were invented by and known to Bell & Tainter prior to Berliner and were, therefore, intended to be covered by the claims of the Bell & Tainter patent No.

341,214 in suit, even though said patent made no specific mention of such feature. This is the whole purport of this entire branch of the case.

Under-cross-examination ,Dr.Bell admitted that the matter of making undulating etched records was not within his special department, in the Bell and Tainter experiments, but that Tainter had charge of this matter . Affiant, who was conducting the cross examination of Bell, had no desire to probe this matter with Bell, if Tainter, who knew the actual facts at first hand were to be produced. Complainants counsel thereupon made the following statement upon the record:

"Counsel for Complainant states that according to his latest information Mr.Tainter is alive, and that it is the intention of Counsel for Complainant to examine Mr.Tainter as a witness in this case."

It was the understanding of affiant, and he believes it was the understanding of Complainant's counsel, that Mr. Tainter was to be produced by Complainant. Therefore affiant immediately closed the cross-examination of Dr.Bell, who could only speak from hearsay, as it were, and in order to oblige complainant's counsel, who was about to depart for Europe within a day or two. Nevertheless affiant avers that had it not been for the positive statement on the record that Tainter was to be produced by Complainant he, affiant, would have continued the cross-examination of the witness, Bell, for some time, possibly for several days, in order to probe his knowledge on this subject to the bottom. Affiant believes that the present move of Complainant, under which they closed their case and have issued a notice of trial without having produced the witness Tainter, will result, if unmodified by the Court, in irreparable injury to Defendant's cause in depriving them of testimony on which they had counted and which testimony had been promised by the Complainants.

Aside from the fact that the testimony of Tainter is necessary in this case in order to clear up the doubt which now hangs about the testimony of Dr. Chichester Bell, and to console Defendants for the insufficient cross-examination of Dr. Bell, made insufficient by no fault of Defendant, the testimony of Tainter is necessary for Defendants even though the testimony of Bell were stricken from this case. Defendants believe that Bell & Tainter did make laboratory experiments with laterally undulating etched records, and they believe it possible that Bell & Tainter made experiments with reproducers in the form of freely swinging arms propelled across the record grooves by the record grooves. But they equally believe that these laboratory experiments were unsuccessful, and that they were abandoned by Bell & Tainter because Bell & Tainter failed in their efforts to make them a success. The Defendant believes that the testimony of Tainter would not show that Bell & Tainter anticipated or preceded Berliner, but that Bell & Tainter tried and failed to do what Berliner subsequently did; that the patent in suit therefore was not intended to cover such work as Berliner subsequently did and that this patent does not cover such work as embodied in Defendant's machine. Thus the Tainter testimony would manifestly be of the greatest importance for Defendant as showing that the Berliner invention is entirely independent of and therefore non-tributary to that of Bell & Tainter.

For this reason Defendant would have called Sumner Tainter as his witness had it not been for the statement of Complainant's counsel made October 22nd, nearly two months before Defendant's time expired, that Tainter would be produced and examined on these very matters. On the assumption that the Complainant will not be ordered to produce Tainter

as its own witness, affiant believes that the defense will be seriously prejudiced if Defendant is not permitted to call Tainter and to examine him as one of Defendant's witness.

Arthur Bissup

Sworn to and subscribed before me this 11th day of March 1901.

David S. Clarkson
Notary Public D.C.

IN THE CIRCUIT COURT OF THE UNITED STATES,
FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY,)
)
vs.)
)
NATIONAL GRAMOPHONE COMPANY) IN EQUITY.
)
and FRANK SEAMAN.)
)

TESTIMONY IN REPLY for Complainant taken pursuant to annexed notice before Reeve Lewis, a notary public in and for the District of Columbia, at the offices of Philip Mauro, Esq., No. 620 F.St., Washington, D.C., under and in accordance with Sections 863, 864 and 865 of the Revised Statutes of the United States in such cases made and provided, beginning at 10.30 A.M., October 22d, 1900.

Present: Philip Mauro, Esq., for Complainant,
Gustav Bissing, Esq., for Defendants.

AND THEREUPON Dr. Chichester A. Bell, a witness produced on behalf of Complainant, being first duly sworn, deposes and says in answer to interrogatories propounded by Mr. Mauro, as follows:

Q.1. Please state your name, age, residence and occupation? A. Chichester A. Bell; of lawful age, residence, Richmond, Surrey, England; occupation, physicist.

Q.2. Are you the C.A.Bell named as one of the grantees of U.S.Letters-patent No.341,214,granted May 4th 1886,forRecording and Reproducing Speech and other Sounds?

A. I am.

Q.3- Please state where and when the inventions described and claimed in that patent were made?

A- They were made in the Volta Laboratory in Washington between 1881 and 1885.

Q.4- Do you mean that the work extended over the period mentioned in your last answer,or merely that the inventions were made between those dates. A- the work extended pretty well over the whole period.

Q.5- Please state who composed the Volta Laboratory Association and for what purpose it was organized?

A- Alexander Graham Bell, Sumner Tainter and myself; and it was organized for the purpose of making inventions. After its organization we decided to confine our work mainly to improvements in recording and reproducing sound.

Q.6 The specification of your patent No.341,214, after describing the reproducer mounted on a universal joint, states that such reproducer so mounted is specially adapted for use in connection with a record in the form of a groove with sloping walls, and the form of record particularly described in said patent is one of varying depth;

please state whether the Volta Laboratory Associates prior to the application for said patent were familiar in practice with any other form of record and if so, with what form.

A- Yes, we made a great many experiments with records in the form of zig-zag lines, cut out in waxy substances, and with similar records etched in metal; and we found that our reproducer worked as well with those as with the records of varying depth.

Q.7- State briefly the operation of making records of zig-zag form by etching in metal as practiced by the Volta Laboratory associates? A - Those experiments were made mainly by Mr. Tainter and by Mr. A.G. Bell. The vibrating style was arranged so as to cut a zig-zag line on a waxy surface, or to cut a zig-zag line in a thin layer of a waxy substance spread on metal, the surface of the metal being subsequently etched by well known processes. Sometimes we used galvanizing and sometimes etching fluids.

Q.8-n Were you or not, prior to the application for patent No. 341,214, aware of the capacity of the record groove in various forms of records made by you to feed the reproducing stylus laterally across the record, and if yes, state how such familiarity was acquired? A- Yes, I was perfectly aware of that, as the result of a great number of experiments in which the groove cut in wax was made to carry the reproducing style across the record.

Q.9- If the result of that work gave you a preference for a particular mechanical form of apparatus, please state the reasons that determined such preference. A- I found that while that arrangement worked very well with a long lever it was not quite satisfactory when the lever was made as short as I wished to make it to keep the size of the instrument within reasonable limits, and therefore some

feed mechanism was added to the instrument so as to make the reproducer roughly follow the motion of the record.

Q.10- As a matter of fact, would a short lever follow the record to some extent? A- Yes, it would, but you couldn't rely on it always to remain in the groove.

Direct Examination closed.

Cross-examination by Mr. Bissing-

X.Q.11- Will you please tell me what direct share you had in the preparation of the application on which the patent in suit was granted. I mean to ascertain whether you personally consulted the gentleman who drew the application, whether you left that to your co-inventor Mr. Tainter, or whether perhaps you sent a written draft of instructions to your solicitor instead of calling personally upon him?

A- I believe I had a great many personal communications with the gentleman who drew up the specification; I don't remember drawing up any written statement; I believe the communications were all oral.

X.Q.12- About what time, so near as you can now remember, did you reach results with your records cut in wax, I mean your vertically undulating cut wax records, which convinced you that the cut wax record was a success and, if perhaps not ready just at that time to be put upon the market, was yet the type of record which you proposed to push?

A- Very early in 1881, in fact it was before the Volta Laboratory Association was actually formed.

X.Q.13- Were your experiments with the laterally undulating records made at an earlier or a later date?

A- I don't like to speak positively on that point for the simple reason that I myself have not made many ex-

periments of that kind, but my impression is that experiments of that kind were made very shortly afterward by Mr. Tainter.

X.Q.14- What was the object of making experiments on laterally undulating records, at a time when the vertically undulating cut wax record had been decided upon by you to have been a success and to be the record which you proposed to push?

A- Of course we had to make experiments to find out the best form and to make perfectly certain on that point, and that could only be done by experiments; in fact we tried everything we could think of whether it seemed promising or not.

Our specification does not include anything like the number of experiments we made.

X.Q.15- Is it not a fact that you obtained very much better results with your vertically undulating cut wax record than with any laterally undulating etched record you ever experimented with?

A- My recollection is that it was very hard to distinguish one from the other as far as results went, but the vertically undulating record was found in every way to be the most convenient, and that's why we adhered to it.

X.Q.16- Do you happen to remember the exact mode of preparing the particular laterally undulating etched record which gave you the best results?

A- I don't think I would like to speak positively on that point, Of course, you will understand that that was not my department. This section of the work was done chiefly by Mr.Tainter.

X.Q.17- Mr.Tainter is alive to-day is he not? A- I have not seen him for many years.

Counsel for Complainant states that according to his latest information Mr.Tainter is alive, and that it is the intention of Counsel for Complainant to examine Mr.Tainter as a witness in this case.

Cross-examination closed.

R.D.Q.18- How did the zig-zag cut record compare as to results with the cut record of varying depth? A-Well, when the undulations were not too pronounced they gave very much the same results.

Signed- Chichester A.Bell.

Certificate of Magistrate waived.

IN THE CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York.

AMERICAN GRAPHOPHONE CO.

VS.

IN EQUITY.

NATIONAL GRAMOPHONE CO. ET AL.

AFFIDAVIT OF PHILIP MAURO.

County and State of New York, SS.:

PHILIP MAURO, being duly sworn, says:

I am counsel for complainant. I have read Mr. Bissing's affidavit verified March 11, 1901.

The deposition of Dr. Bell was part of complainant's rebutting proofs. It was taken to show that the patentees Bell & Tainter had used their reproducer (which is the invention in controversy in the suit) with laterally undulating as well as with vertically undulating records. Whether or not Berliner was the inventor of the laterally undulating record, and whether or not he was anticipated therein by Bell & Tainter, are questions not in controversy in this suit.

It was my intention, as stated on the record during the examination of Dr. Bell, to produce Mr. Tainter to testify to the same facts to which Dr. Bell testified, namely that they were familiar with laterally undulating records, and had used them with their floating reproducer. I have been unable, however, to produce Mr. Tainter, for the reason that he is now, and for many months past has been, confined in a sanitarium under treatment for a chronic disease of the stomach. I desire Mr. Tainter's deposition and would have produced him, had it been possible.

11 It is of very great importance to complainant to submit
this case upon final hearing at the April term, whereas
defendants have been, for many months past, putting every
possible obstacle in the way of the trial of this case.
Defendants have already prepared another motion for leave
to take surrebutting testimony, which motion, I am informed,
11 was served at my office in Washington on the 13th inst.
and noticed for hearing on Friday, the 22nd inst.

Philip Mauro.

Subscribed and sworn to before me,

this 14th day of March, 1901.

Charles S. Camp.
Notary Public.
N.Y.C.

IN THE CIRCUIT COURT OF THE UNITED STATES
For the Southern District of New York.

AMERICAN GRAPHOPHONE CO.

VS.

IN EQUITY.

NATIONAL GRAMOPHONE CO.
and FRANK SEAMAN.

COPY OF LETTER FROM CHARLES SUMNER TAINTER,
RECEIVED AT THE OFFICE OF PHILIP MAURO, ESQ.,
137 BROADWAY, NEW YORK CITY, ON MARCH 15, 1901.

THE WALTER SANITARIUM.

Walters Park, Pa., Mch. 13th-1901.

My dear Mr. Mr. Mauro:-

Yours of the 9th received and I am very sorry to learn that the opposition is determined to examine me in their case for I shall be compelled to oppose them in every way that I can. I have not been as well for several weeks past and my nerves are much weaker in consequence; for this reason I am in no condition to stand an examination.

If I was able to undertake it I would give my testimony freely, as I have done in the past, for I am anxious to help out in every way that I can; but in my present condition it is a very serious undertaking which would probably lead to disastrous consequences for me. I trust therefore that you will use every effort to protect me.

Very truly yours,

Chas. S. Tainter."

IN THE UNITED STATES CIRCUIT COURT
For the Southern District of New York.

AMERICAN GRAPHOPHONE CO.

VS.

IN EQUITY.

NATIONAL GRAMOPHONE CO.
ET AL.

AFFIDAVIT OF PHILIP MAURO.

County and State of New York, SS.:

PHILIP MAURO, being duly sworn says: I am of counsel for complainant herein. I have read the affidavit of Mr. Bissing, verified March 13, 1901, in support of a motion to reopen this case for testimony in surrebuttal.

✓
(a.) Edison's British patent No. 1644 of 1878, was before this Court in the Leeds & Baldwin case, wherein the claims here involved were sustained. It was also before the Court upon complainant's motion for preliminary injunction, Figs. 1 and 2 of the patent being particularly relied on by the defendants. Complainant's ^{counsel} contended, at that time, that the reproducer arm was provided with a clamp, shown in the drawings. These figures are discussed in extenso by defendant's expert in his deposition.

✓
(b) One of the utilities of the freely mounted reproducer is that it automatically compensates for all deviations of the record-groove from a true spiral. These deviations, however caused, have been termed "drunkenness" of the record. This utility has been prominent from the beginning. It is described in the patent, and the views thereon of experts on both sides have been given in their testimony already taken.

(c). Mr. Lyons, defendant's expert, has already and at great length, given his reasons for arguing that the laterally undulating etched record was new with Berliner.

In rebuttal, complainant showed that, on a previous occasion this witness/ (then in the capacity of attorney for Berliner) argued that the Cros French patent disclosed the laterally undulating etched record. This Cros French patent was brought out in complainant's opening proofs, and Mr. Lyons has had full opportunity to state his views thereon.

(d). The claim of Berliner's application, No. 534,543, referred to under this head of Mr. Bissing's affidavit, was before the court in the preliminary injunction motion. It is now before the court in the record herein. Nothing appears in Mr. Bissing's affidavit to indicate that the language of the claim is uncertain or that the views of an expert would aid in comprehending it.

(e). The experts on each side have already given their respective theories touching the operation of the device shown in patent No. 375,579. This patent, however, has been withdrawn.

Philip H. H. H.

Sworn to before me, this :

19th day of March, 1901. :

Oliver S. S.
Notary Public,
N.Y.C.

____ ooOoo ____

-: IN THE CIRCUIT COURT OF THE UNITED STATES:-

For the Southern District of New York.

American Graphophone Company)	
)	
vs.)	
)	In Equity.
National Gramophone Company)	
)	
and Frank Seaman.)	

Proofs in sur-rebuttal taken on behalf of Defendant, in accordance with an order of the Court signed March 23, 1901, under the provisions of the 67 Rule in Equity, pursuant to agreement, before Gustav Dittmar, Esq., a Notary Public in and for the District of Columbia, acting herein as Special Examiner by consent, at the offices of Lyons & Bissing Esqs., #908, G., Street, N.W., (McGill Building) Washington, D.C., beginning Monday, April 1st, 1901, at 1 P.M.

Present:

Philip Mauro, Esq., for Complainant.

Gustav Bissing, Esq., for Defendants.

JOSEPH LYONS.

Being called and sworn as a witness on behalf of the defendants answers to interrogatories propounded to him by Mr. Gustav Bissing, as follows:

Q.1. You are the same Joseph Lyons who has previously testified in this case?

A- I am.

Q.2- In your testimony given in this case you have taken the position that Emile Berliner was the first to produce a laterally undulating record and the first to give to the world sufficient knowledge by which such a record could be produced.

In an interference between Berliner and White in the United States Patent Office referred to by Mr. Cameron on rebuttal, in answer to Question 17, in which you were acting as counsel for Mr. Berliner, you seem to have taken a different position.

If you can, please explain this discrepancy?

A- The interference between Berliner and White to which Mr. Cameron refers in answer to Question 17, was declared on November 18, 1887. The motion for dissolution of the interference to which Mr. Cameron refers, was filed on March 31st 1888; that is to say, almost exactly thirteen years ago. Under ordinary circumstances I should not be willing to state now what passed through my mind thirteen years ago; but it happens that the record of the proceedings in that interference, although mutilated, is now before me and my recollection of the circumstances which surrounded me at that time is somewhat revived by that record. When that interference was declared I certainly believe that no other human being than Mr. Berliner had ever contemplated a sound *laterally undulating or etched* sound

record fit for reproduction of the recorded sounds.

Then it happened that on March 30th 1888, Mr. Berliner came to my office in connection with some of his pending applications, or, possibly, in connection with some of the work that he was doing at that time. Mr. Berliner always had free access to the books on my bookshelves and he would pick out a book here and there and glance over it, and sometimes discuss with me what he read. On that particular day he took from my bookshelves a volume of a German work entitled "TELEPHON MIKROPHON UND RADIOPHON." By THEODOR SCHWARTZE, published at Vienna, Budapest and Leipzig, by one of A. Hartleben. This volume is a series of a work known as the "Elektrotechnical Library;" it is Vol. VI thereof. The title of this book would not suggest that it contains any reference to the art of recording and reproducing sounds. It does, however, contain such reference and Mr. Berliner discovered it and called my attention to it. On pages 225, and 226 of this book, the ~~existence~~ substance of the paper of Charles Gros deposited at the French Academy is given, and when Mr. Berliner read it, he ~~was~~ became very much excited and said that he feared that Gros anticipated him in his work on recording and reproducing sounds. The thing came to both of us like a thunderbolt from a clear sky, since neither of us ever had the remotest idea that anybody besides Mr. Berliner had ever entertained the idea of recording sounds by etching.

Mr. Berliner immediately said that if Gros anticipated

him he wanted a judicial decision upon the question and directed me to test this question on a motion for dissolution of the interference with White. The next day the motion for dissolution was filed.

As I have stated before both Mr. Berliner and myself had, up to that moment, lived in the belief that nothing existed in the prior art or literature that had the remotest bearing upon his invention; and finding now that there was a ~~xxxx~~ writer who had contemplated the same thing before Mr. Berliner, we became un~~u~~lly excited and looked upon the Cros publication as a very serious matter.

I now see that both my judgment and that of Mr. Berliner became warped by the suddenness of the discovery of Cros.

Between the time of the filing of the motion for dissolution and the time when the motion was argued, the Cros publication had lost its formidable aspect, since upon close reading of that publication, it appeared that Cros merely suggested the recording of ~~xxxx~~ ^{sound} by etching but apparently had never done it and had surely not given ~~xxxx~~ adequate instructions how to do it. Yet the motion having been filed and having been filed in good faith, we thought it best that the decision of the Patent Office be obtained.

The Patent Office rendered its decision and in the same the Examiner said as follows:

" With the view I take of the testimony I must hold that the publication in the Comptes Rendus does not disclose the invention in issue.

Even if it did, it can be made to appear only as an abandoned experiment, assuming that it

ever reached the stage of experiment. The only intimation of an attempt by the author to carry the invention to practice is in the closing sentence in which he says he is trying to discover a practical embodiment for a particular form. There is nothing to show that he ever recorded sound, still less, (if it were possible), to show he ever reproduced sound by his process. His description seems to have produced no sensation among the savants of the Academy. He never followed it up, and it was abandoned and dead and forgotten, and cannot now be galvanized into life and importance. It never possessed to defeat the claims of men who had in good faith made the invention, reduced it to practical form, and given the benefit of it to the public."

By this decision of the Patent Office both Mr. Berliner and myself had our fears of anticipation by Cros removed; ~~it was~~ and ever since that time I entertained the views with respect to Cros which I expressed in my former deposition in this case. It happens that the Courts ~~it~~ when considering the Cros publication agreed with the Examiner in the Patent Office.

Direct-examination closed.

Cross-examination by Mr. Mauro-

X.Q.3- The issue in the interference to which ~~you~~ ~~a~~ have referred embrace something more than a laterally undulating sound record, did it not?

A- Yes. The issue comprised a combination of a diaphragm, a pivoted style and a laterally undulating sound record. But you will observe that the decision of the Examiner ~~X.Q.~~ shows that Cros had neither the sound record nor a pivoted style.

X.Q.4- When you discovered the Cros publication you were of the opinion that it was a publication prior to the invention of Mr. Berliner, that it described a laterally undulating sound record, and that it proposed the etching process as a means by which such a sound record could be obtained. ~~Am I correct in this statement?~~ ~~I xxxxxx this statement~~ am I correct in this statement?

A- At that time I believe that the publication anticipated Mr. Berliner's reduction to practice of a laterally undulating sound record, and that the sound record referred to by Cros was to be produced by photo-engraving which might, perhaps, be called a species of etching ~~xxx~~ if language is ~~xxxxxxx~~ somewhat stretched.

X.Q.5- I have not asked what your opinion was either as to anticipation or as to reduction to practice, which are questions of law. I will ask you now if you thought at the time mentioned in the preceding question that the Cros publication described a laterally undulating sound record?

A- Yes.

X.Q.6- Do you think so now?

A- I now think that the Cros publication contains a suggestion of how to make a laterally undulating sound record, but that the suggestion is inadequate. I can, therefore, not say that it describes a laterally undulating sound record, except as ~~xx~~ something that the future might bring.

X.Q.7- You mean that the photo-engraving method is inadequate to produce such sound records?

A- No, I do not mean exactly this, but I mean that Cros does not describe adequately, how to produce a laterally undulating sound record for photoengraving. Merely saying that it is to be so produced does not teach anybody to produce it.

Cross-examination closed.

No Redirect.

Joseph Lyons

Notary's certificate waived.

of January 5, 1903,

CIRCUIT COURT OF THE UNITED STATES,

District of New Jersey.

IN EQUITY.

FRANK SEAMAN, UNITED STATES GRAMOPHONE
COMPANY and BERLINER GRAMOPHONE COMPANY,
Complainants,

vs.

VICTOR TALKING MACHINE COMPANY,
Defendant.

SUR MOTION FOR PRELIMINARY INJUNCTION.

Additional Affidavit of Eldridge R. Johnson on Behalf
of Defendant.

State of Pennsylvania, :
City and County of Philidelphia, : ss.:

ELDRIDGE R. JOHNSON, being duly sworn according to
law, deposes and says as follows:

I am/president of the Victor Talking Machine Company,
the defendant in the above entitled case.

The Victor Talking Machine Company never marked the
machines or records made by it with the Berliner patents
noted in the three suits just instituted in the above entitled
cause, by name, date or otherwise; that the talking machines
and records manufactured and sold by the Victor Talking
Machine Company are of the same construction and operated
in the same manner, and the records made by essentially the
same processes as they were made by me under my patents
before the license of September 28, 1901, was granted by the
Berliner Gramophone Company and before the Victor Talk-
ing Machine Company took over my said talking machine
business and patents, etc.

That the said license taken by me October 28, 1901,
from the Berliner Gramophone Company, and assigned by me

X

to the Victor Talking Machine Company, October 5, 1901, was taken by me rather as a matter of insurance than otherwise in the event that the Courts should hereafter decide the said patents to be valid. This deponent and the defendant company have never ascertained whether the said patents are valid or not.

In order to have this question decided and ascertained the defendant company has joined with the United States Gramophone Company and the Berliner Gramophone Company in several suits against the infringers of the said Berliner patents, of which there are quite a number, and have, in the bills in the said suits, set forth therein, in the usual formal manner, the facts. That there is very grave question regarding the validity of the Berliner patents has always been known to this deponent and this defendant, particularly as evidenced by the fact that the defendants in the several cases in which the said Berliner patents were involved have succeeded in preventing any of the cases from going to final hearing, and the complainants have never brought the said cases to final hearing and the defendants have set forth very extended defenses in which there may be considerable merit.

X

This defendant does not admit the validity of the said patents and never has so done and has very grave doubts regarding the validity of the said patents.

That the said Berliner patents in these three suits between the above named parties are invalid and void has been set forth in several suits in which the complainants have never brought the cases to final hearing, as, for instance, as set forth in the Defendant's Answers in three separate suits brought upon the said Berliner Patents No. 534,543, No. 548,623 and No. 564,586 in the suits of the United States Gramophone Company and Berliner Gramophone

Company against the National Gramophone Corporation, in the United States Circuit Court for the Eastern District of Pennsylvania, of April Sessions, 1900, Nos. 33, 34 and 35, for infringement of the said patents, copy of which said Answers are hereto attached marked Exhibits 1, 2 and 3.

Attention is also called to the fact that a preliminary injunction in each of these cases was refused on the ground the complainants' patents were unadjudicated and no public acquiescence was sufficiently proven.

This deponent denies that it is precluded from disputing the validity of these Berliner patents.

Further, if the Berliner Gramophone Company, on September 28, 1901, had no right to grant any license to this deponent or to the defendant, as contended by the complainant, Seaman, this defendant would, therefore, have no license if this contention is good, and is at perfect liberty on this basis to dispute the validity of the said patents, which it does.

Further, the Victor Talking Machine Company, as hereinbefore stated, took the said license, if it is an existing license, as a matter of insurance for its use in the event that the patents should be finally adjudicated to be valid, which have not yet been so adjudicated, but contends that the mere holding of the license, when it does the patents and does not advertise that it is operating under not mark its goods with the said patents, but is manufacturing and selling the same construction of talking machine and records, operated in the same manner and produced in the same manner as before the said license was acquired, does not preclude it from denying or disputing the validity for the reasons set forth in the Answers hereto attached, marked "Exhibits 1, 2 and 3".

(Signed) ELDRIDGE R. JOHNSON.

Sworn to and subscribed before me this fifth day of January, A.D. 1903.

Notary Public.

U.S. Circuit Ct of S. Dist of N.Y.

American Graphophone Co.
vs.

National Graphophone Co. &
Frank Seaman,

copied from

COPY

from

THE NATIONAL ARCHIVES

Record Group No. 21

U.S. Circuit Court
Eastern District of Pennsylvania
October 1898
Equity No 34

U.S.C.C. E. D. C.
 American Graphophone Co. vs. Berliner Gramophone Co., et als.
 Defendants' Exhibit No. 1, U.S. Patent No. 27,827
 Apl. 10, Pease, Engraving Machine.
 1860

W. H. Pease

Engraving Machine.

N^o 27827.

Patented Apr. 10, 1860.

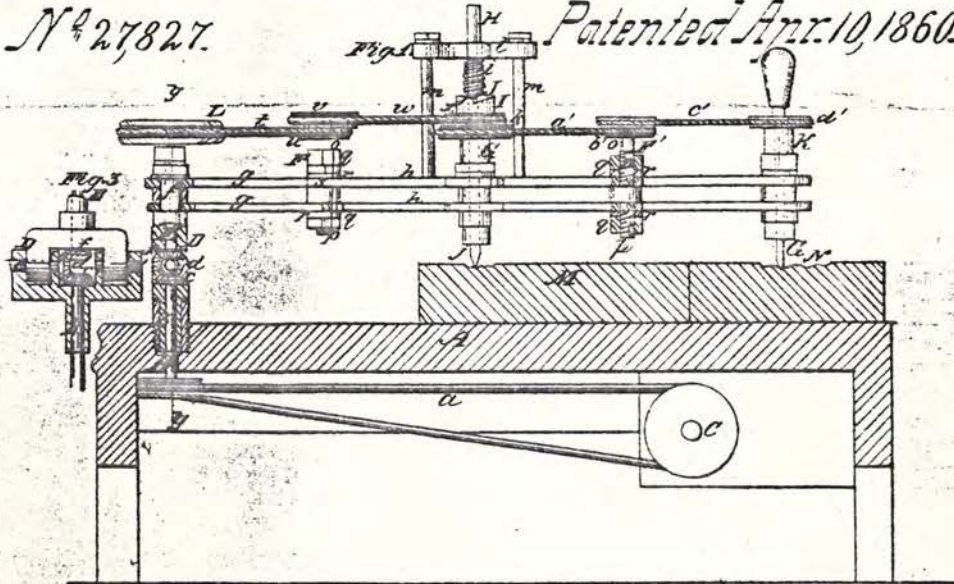
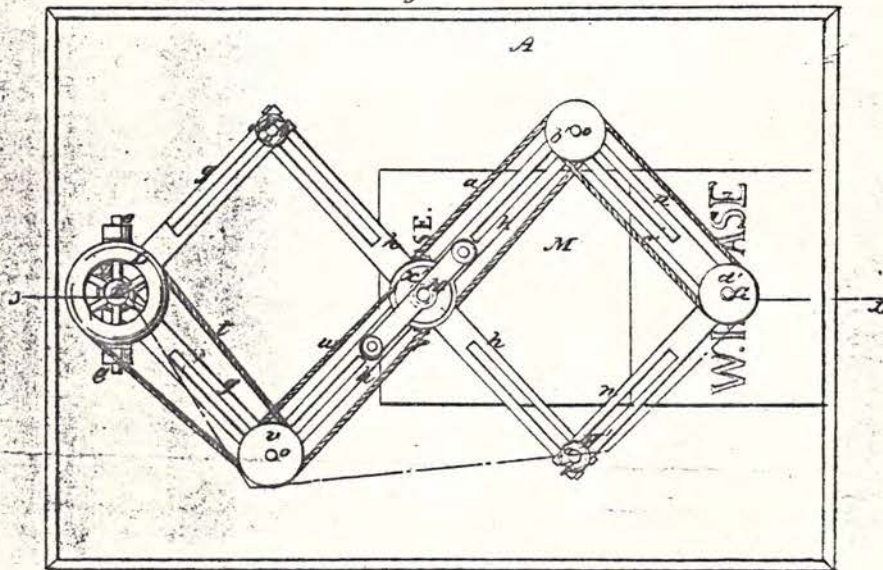


Fig. 2.



Witnesses.

*J. L. Brown
 R. S. Brown*

Inventor.

*W. H. Pease
 per Messrs. J. L. Brown & R. S. Brown*

U. S. Circuit Court, Eastern Dist. of Penna.

Oct. Sess., 1898. No. 34. American Graphophone Co. v. Berliner Gramophone Co., *et al.*
Defendants' Exhibit, No. 1. Samuel Bell, Special Examiner.

W. H. PEASE, GOSHEN, INDIANA.

MACHINE FOR CARVING MARBLE, ETC.

No. 27,827. Patented April 10, 1860.

Application Filed Feb. 4, 1860.

To all whom it may concern:

Be it known that I, W. H. PEASE, of Goshen, in the County of Elkhart and State of Indiana, have invented a new and useful Machine for Carving, Lettering and performing similar or analogous work in Wood, Metal or Stone, and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed drawings making a part of this specification, in which:

Figure 1, is a side sectional view of my invention, taken in the line x-x figure 2.

Figure 2, a plan or top view of ditto.

Figure 3, a detached sectional view of a portion of ditto, taken in the line y-y of figure 1.

Similar letters of reference indicate corresponding parts in the several figures.

This invention is chiefly designed for operating from patterns, and may be advantageously used for carving, lettering, planing irregular or winding surfaces and the like. The invention consists in the employment or use of a system of levers, known as the lazy tongs, provided with an index, and cutter, and arranged substantially as hereinafter shown and described to effect the desired end.

To enable those skilled in the art to fully understand and construct my invention, I will proceed to describe it.

A, represents a table or platform in which, near one end, a vertical shaft B is placed and rotated from a driving shaft C by means of a belt *a*. The shaft B, is fitted within a suitable bearing *b* in the table or platform, and it has a bevel wheel *c* on its upper end, which wheel *c*, gears into a corresponding wheel *d* on a horizontal shaft *e*, which forms one of the pintles of a joint D, the construction of which is shown clearly in figure 3. The other pindle *e'* of the joint performs no other than its legitimate function of a pindle.

In the upper part of the joint D, a vertical arbor E is placed, said arbor having a wheel *f*, on its lower end, which wheel gears into the wheel *d* of shaft *e*, a rotary motion is thereby communicated from the shaft B to the arbor E. On the socket or bearing *f*, of the arbor E, two levers *g, g*, are fitted placed on loosely. The outer parts of these levers are slotted longitudinally and they are connected to levers *h, h*, which have their adjoining ends, also slotted longi-

tudinally, by means of adjustable joints F. The levers *h, h*, are crossed as shown clearly in figure 2, and they work on a hollow spindle G, through which an arbor H, passes and on which a cam I is placed loosely. Through the arbor H, a pin J, passes horizontally, said pin resting on the cam I and kept thereon by a spiral spring *i*, on the arbor H, as shown clearly in figure 1. To the lower end of the arbor H, a cutter *j* is attached, and on the upper part of the hollow spindle G, there is placed a pulley *k*. The upper part of the arbor H has its bearing in a bar *l* attached to the upper end of two uprights *m, m*, as shown clearly in figure 1.

The levers *h, h*, are connected at their outer ends to levers *n, n*, by joints F¹ which are constructed precisely similar to the joints F, and the outer ends of the levers *n, n*, are fitted loosely on a hollow spindle K, in which an arbor G¹ is placed.

The joints F¹, F¹, are formed of pintles *o, o*, which pass through hollow screws *p, p*, on which nuts *q, q*, are fitted, the screws *p, p*, having washers *r, r*, on them, and they each have also parallel smooth sides *s, s*, arranged to fit into the slots of the levers. By adjusting the nuts *q, q*, the parallel sides *s, s*, are firmly secured in the slots of the levers, and by relaxing or unscrewing the nuts the joints F, F¹, may be adjusted so as to virtually increase or decrease the length of the levers.

The system of levers *g, g, h, h, n, n*, form the lazy tongs, as clearly shown in figure 2.

On the upper part of the arbor E a pulley L is secured, around which a belt *t* passes, said belt also passing around a pulley *u* which is placed loosely on the upper part of one of the pintles of one of the joints F. The pulley *u* has a pulley *v*, attached to it, around which a belt *w* passes, said belt also passing around a pulley *x*¹ on the cam I. The pulley K of the hollow spindle G, has a belt *a*¹ passing around it, said belt passing around a pulley *b*¹, on a pindle of one of the joints F¹. The pulley *b*¹ is double-grooved and a belt *a*¹, also passes around it, the belt *a*¹ also passing around a pulley *a*² on the arbor G¹.

The operation of the machine is as follows:— Suppose for instance that it is required to carve letters in a stone slab. The slab M is secured on the table or platform A in any proper way, and a pattern N of the letters to be cut also to be placed on the table beneath the arbor G¹. The shaft C is then

rotated by any convenient power, and the point of the arbor G passes over the letters of the pattern N. The movement of the arbor G¹, which is a tracer, is communicated to the arbor H through the medium of the levers described. This arbor H, not only has the tracing movement of the arbor G¹ communicated to it, but it also has given it an up-and-down movement by the cam I, pin J, and spring i, and these movements combined cause the tool j¹ to cut letters in the stone M, corresponding to those of the pattern, but smaller in size. The depth of the cut will also correspond with the original as the joint D, admits of vertical movement of the whole system of levers. In case of carving in wood, and planing curved or irregular surfaces, where no packing is required and consequently no up-and-down motion of the arbor H, the motion of the cam I may be reversed and the latter will rotate the arbor only.

By having the rotary motion of arbor H, communicated to arbor G¹ by belts a¹ c¹ and a proper tool fitted in arbor G¹ the arbor H may be used as a tracer, and the pattern being placed under it the tool in arbor G¹ may perform the work, thereby enlarging from the pattern instead of diminishing from it.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

The levers g, h, n, arranged as shown to form the lazy tongs, provided within the joints D, and the arbors H, G¹, operated from the driving shaft by means of the gear and belts substantially and for the purposes set forth.

W. H. PEASE.

Witnesses:

E. M. CHAMBERLAIN,
JOHN H. BAKER.

U. S. C. C. W. D. of Pa.

American Graphophone Co. vs. Berliner Gramophone Co., et als.

Defendants' Exhibit No. 2, U. S. Patent No. 38,823,

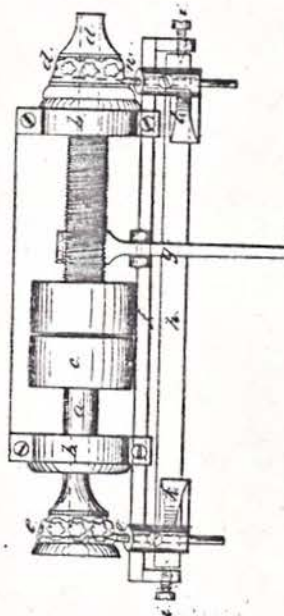
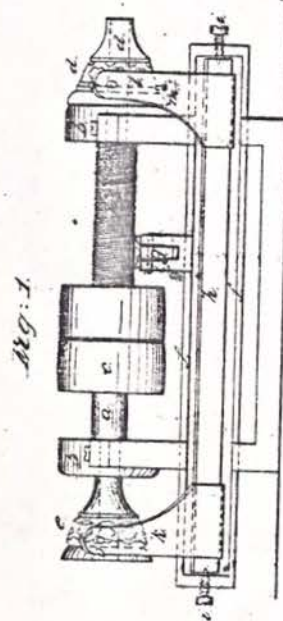
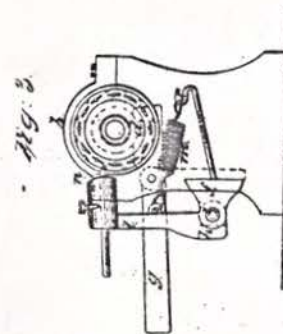
June 9, 1883 Hayden, Rose Engine

Samuel Rose
J. P. Enter

H. W. HAYDEN.
MODE OF ORNAMENTING LAMP STANDS, &c.

No. 38,823.

Patented June 9, 1863.



Witnesses:
M. J. Paul
Frederic Paul

Inventor
H. W. Hayden

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UNITED STATES PATENT OFFICE.

HIRAM W. HAYDEN, OF WATERBURY, CONNECTICUT.

MODE OF ORNAMENTING LAMP-STANDS, &c.

Specification forming part of Letters Patent No. 38,823, dated June 9, 1863.

To all whom it may concern:

Be it known that I, HIRAM W. HAYDEN, of Waterbury, in the county of New Haven and State of Connecticut, have invented, made, and applied to use a certain new and useful Improvement in Ornamenting Lamp-Stands and Similar Articles; and I do hereby declare the following to be a full, clear, and exact description of my said invention, reference being had to the annexed drawings, making part of this specification, wherein—

Figure 1 is a side view of an apparatus employed by me for ornamenting said articles. Fig. 2 is a plan of the same, and Fig. 3 is an end view.

Similar marks of reference indicate the same parts.

Various articles—such as silver-ware and pencil-cases—have been ornamented by means of a die or a roller with the design engraved thereon and pressed upon the surface to be ornamented, and a chaser or engraving-tool has been employed to ornament pencil-cases, &c., by longitudinal lines, straight or wavy, intermitted or continuous.

The nature of my said invention consists in a method of ornamenting lamp-stands and similar articles by a series of parallel lines engraved upon the surface of such articles by a standing tool, against which said article is caused to rotate, and which tool is raised from the surface at certain points, so as to leave the said surface plain at such points, to produce the figure or pattern of the ornamentation.

To enable others to ornament lamp-stands and similar articles with this character of engraving, I have represented a device which is very simple and easily employed for this purpose.

a is a mandrel, sustained in the heads *b b* and driven by competent power applied to the pulley *c*. At one end of this mandrel *a* the lamp stand *d* or other article is attached in any convenient way by setting upon a corresponding shape or otherwise. At the other end of this mandrel is a pattern, *e*, corresponding in size and shape to the exterior of the article to be engraved. Upon this pattern *e* is marked out the design to be engraved, and the parts that are to be ornamented on the

lamp-stand by the engraved lines are cut out, removed, or countersunk.

f is a slide rest, that is caused to progress longitudinally and parallel to *a* by a screw-thread on *a*, taking the end of the lever *g*, and this slide rest *f* is fitted with a rock-shaft, *h*, on centers *i i*, and said shaft *h* carries standards *k* and *l*, and *m* is a spring to keep *l* toward *d*. In or supported by the standard *l* is an engraving-tool, *n*, and *o* is a tracer in *k*. These parts of the instrument are adjusted so that the distance between *n* and *o* is the same as between *d* and *e*, and when the tracer *o* rests on the surface of *e* the tool *n* is clear of the surface of *d*; but so soon as the tracer enters a depression in the pattern the said tool begins to cut by being drawn to *d* by the spring *m*. By this means the lamp-stand or similar article is ornamented by a series of spiral or nearly horizontal lines by the said tool acting when the tracer *o* is in the cavity or depression in *e*, and being relieved when the tracer rests upon the surface of *e*, so that the interruption of the engraved line produces the pattern, and the screw *p* causes the movement of the slide *f*, in order that the entire surface to be ornamented may be traveled over.

By this mode of engraving, circular articles—such as lamp stands, &c.—can be ornamented with great rapidity and beauty.

If colored lacquer or enamel is applied to the article previous to engraving, a very bold and handsome appearance is given to the ornamentation. In this instance a transparent lacquer should afterward be employed.

What I claim, and desire to secure by Letters-Patent, is—

The method herein specified of ornamenting a lamp stand or similar article by interrupted parallel lines engraved upon the surface of such article by a tool in contact with such surface while the said article is being rotated, as specified.

In witness whereof I have hereunto set my signature this 23d day of February, 1863.

H. W. HAYDEN.

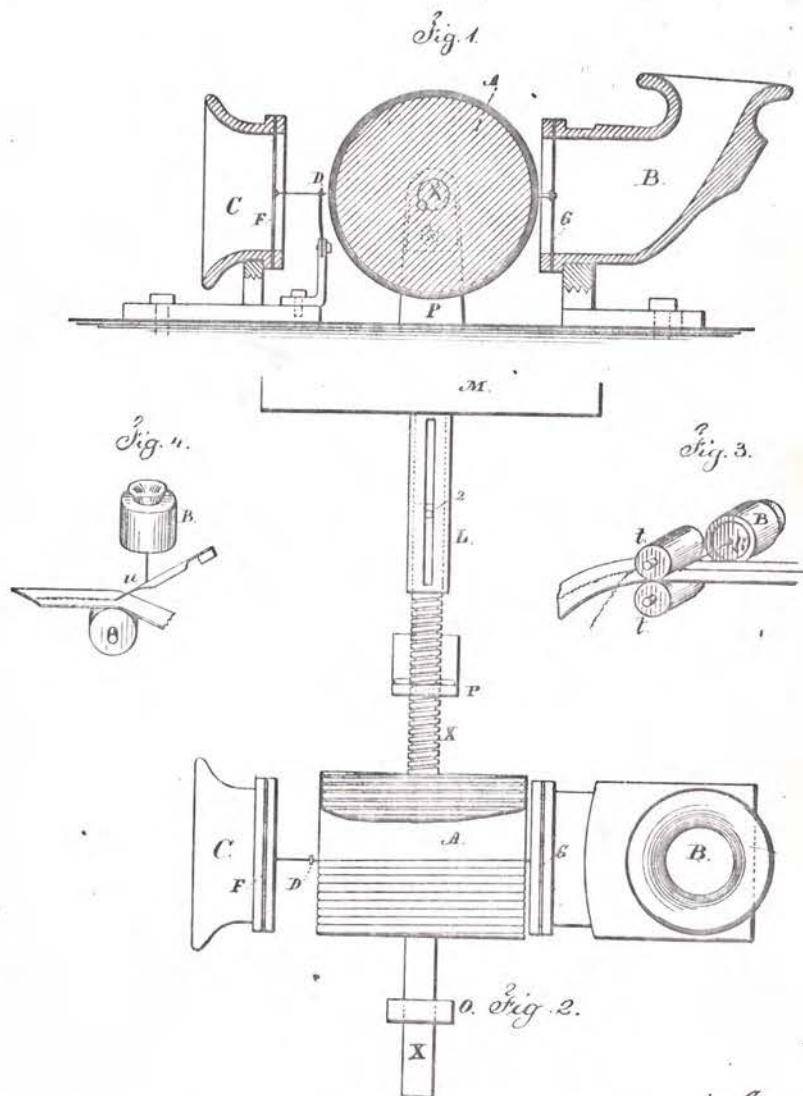
Witnesses:

NATHAN J. BUEL,
THEODORE S. BUEL.

Exh 3

12

T. A. EDISON.
Phonograph or Speaking Machine.
No. 200,521. Patented Feb. 19, 1878.



Witnesses

Chas H. Smith
Harold D. Russell

Inventor

Thomas A. Edison.
per Lemuel W. Perrell
att'y.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

IMPROVEMENT IN PHONOGRAPH OR SPEAKING MACHINES.

Specification forming part of Letters Patent No. 200,521, dated February 19, 1878; application filed December 24, 1877.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented an Improvement in Phonograph or Speaking Machines, of which the following is a specification:

The object of this invention is to record in permanent characters the human voice and other sounds, from which characters such sounds may be reproduced and rendered audible again at a future time.

The invention consists in arranging a plate, diaphragm, or other flexible body capable of being vibrated by the human voice or other sounds, in conjunction with a material capable of registering the movements of such vibrating body by embossing or indenting or altering such material, in such a manner that such register-marks will be sufficient to cause a second vibrating plate or body to be set in motion by them, and thus reproduce the motions of the first vibrating body.

The invention further consists in the various combinations of mechanism to carry out my invention.

I have discovered, after a long series of experiments, that a diaphragm or other body capable of being set in motion by the human voice does not give, except in rare instances, superimposed vibrations, as has heretofore been supposed, but that each vibration is separate and distinct, and therefore it becomes possible to record and reproduce the sounds of the human voice.

In the drawings, Figure 1 is a vertical section, illustrating my invention, and Fig. 2 is a plan of the same.

A is a cylinder having a helical indenting-groove cut from end to end—say, ten grooves to the inch. Upon this is placed the material to be indented, preferably metallic foil. This drum or cylinder is secured to a shaft, X, having at one end a thread cut with ten threads to the inch, the bearing P also having a thread cut in it.

L is a tube, provided with a longitudinal slot, and it is rotated by the clock-work at M, or other source of power.

The shaft X passes into the tube L, and it is rotated by a pin, 2, secured to the shaft, and passing through the slot on the tube L,

the object of the long slot being to allow the shaft X to pass endwise through the center or support P by the action of the screw on X. At the same time that the cylinder is rotated it passes toward the support O.

B is the speaking-tube or mouth-piece, which may be of any desired character, so long as proper slots or holes are provided to re-enforce the hissing consonants. Devices to effect this object are shown in my application, No. 143, filed August 28, 1877. Hence they are not shown or further described herein.

Upon the end of the tube or mouth-piece is a diaphragm, having an indenting-point of hard material secured to its center, and so arranged in relation to the cylinder A that the point will be exactly opposite the groove in the cylinder at any position the cylinder may occupy in its forward rotary movement.

The speaking-tube is arranged upon a standard, which, in practice, I provide with devices for causing the tube to approach and recede from the cylinder.

The operation of recording is as follows: The cylinder is, by the action of the screw in X, placed adjacent to the pillar P, which brings the indenting-point of the diaphragm G opposite the first groove on the cylinder, over which is placed a sheet of thick metallic foil, paper, or other yielding material. The tube B is then adjusted toward the cylinder until the indenting-point touches the material and indents it slightly. The clock-work is then set running, and words spoken in the tube B will cause the diaphragm to take up every vibration, and these movements will be recorded with surprising accuracy by indentations in the foil.

After the foil on the cylinder has received the required indentations, or passed to its full limit toward O, it is made to return to P by proper means, and the indented material is brought to a position for reproducing and rendering audible the sounds that had been made by the person speaking into the tube B.

C is a tube similar to B, except that the diaphragm is somewhat lighter and more sensitive, although this is not actually necessary. In front of this diaphragm is a light spring, D, having a small point shorter and finer than the indenting-point on the diaphragm of B. This spring and point are so arranged as to fall

exactly into the path of all the indentations. This spring is connected to the diaphragm F of C by a thread or other substance capable of conveying the movements of D. Now, when the cylinder is allowed to rotate, the spring D is set in motion by each indentation corresponding to its depth and length. This motion is conveyed to the diaphragm either by vibrations through a thread or directly by connecting the spring to the diaphragm F, and these motions being due to the indentations, which are an exact record of every movement of the first diaphragm, the voice of the speaker is reproduced exactly and clearly, and with sufficient volume to be heard at some distance.

The indented material may be detached from the machine and preserved for any length of time, and by replacing the foil in a proper manner the original speaker's voice can be reproduced, and the same may be repeated frequently, as the foil is not changed in shape if the apparatus is properly adjusted.

The record, if it be upon tin-foil, may be stereotyped by means of the plaster-of-paris process, and from the stereotype multiple copies may be made expeditiously and cheaply by casting or by pressing tin-foil or other material upon it. This is valuable when musical compositions are required for numerous machines.

It is obvious that many forms of mechanism may be used to give motion to the material to be indented. For instance, a revolving plate may have a volute spiral cut both on its upper and lower surfaces, on the top of which the foil or indenting material is laid and secured in a proper manner. A two-part arm is used with this disk, the portion beneath the disk having a point in the lower groove, and the portion above the disk carrying the speaking and receiving diaphragmic devices, which arm is caused, by the volute spiral groove upon the lower surface, to swing gradually from near the center to the outer circumference of the plate as it is revolved, or vice versa.

An apparatus of this general character adapted to a magnet that indents the paper is shown in my application for a patent, No. 128, filed March 26, 1877; hence no claim is made herein to such apparatus, and further description of the same is unnecessary.

A wide continuous roll of material may be used, the diaphragmic devices being reciprocated by proper mechanical devices backward and forward over the roll as it passes forward; or a narrow strip like that in a Morse register may be moved in contact with the indenting-point, and from this the sounds may be reproduced. The material employed for this purpose may be soft paper saturated or coated with paraffine or similar material, with a sheet of metal foil on the surface thereof to receive the impression from the indenting-point.

I do not wish to confine myself to reproducing sound by indentations only, as the trans-

mitting or recording device may be in a sinuous form, resulting from the use of a thread passing with paper beneath the pressure-rollers *t*, (see Fig. 3,) such thread being moved laterally by a fork or eye adjacent to the roller *t*, and receiving its motion from the diaphragm G, with which such fork or eye is connected, and thus record the movement of the diaphragm by the impression of the thread in the paper to the right and left of a straight line, from which indentation the receiving-diaphragm may receive its motion and the sound be reproduced, substantially in the manner I have already shown; or the diaphragm may, by its motion, give more or less pressure to an inking-pen, *u*, Fig. 4, the point of which rests upon paper or other material moved along regularly beneath the point of the pen, thus causing more or less ink to be deposited upon the material, according to the greater or lesser movement of the diaphragm. These ink-marks serve to give motion to a second diaphragm when the paper containing such marks is drawn along beneath the end of a lever resting upon them and connected to such diaphragm, the lever and diaphragm being moved by the friction between the point being greatest, or the thickness of the ink being greater where there is a large quantity of ink than where there is a small quantity. Thus the original sound-vibrations are reproduced upon the second diaphragm.

I claim as my invention—

1. The method herein specified of reproducing the human voice or other sounds by causing the sound-vibrations to be recorded, substantially as specified, and obtaining motion from that record, substantially as set forth, for the reproduction of the sound-vibrations.

2. The combination, with a diaphragm exposed to sound-vibrations, of a moving surface of yielding material—such as metallic foil—upon which marks are made corresponding to the sound-vibrations, and of a character adapted to use in the reproduction of the sound, substantially as set forth.

3. The combination, with a surface having marks thereon corresponding to sound-vibrations, of a point receiving motion from such marks, and a diaphragm connected to said point, and responding to the motion of the point, substantially as set forth.

4. In an instrument for making a record of sound-vibrations, the combination, with the diaphragm and point, of a cylinder having a helical groove and means for revolving the cylinder and communicating an end movement corresponding to the inclination of the helical groove, substantially as set forth.

Signed by me this 15th day of December, A. D. 1877.

THOS. A. EDISON.

Witnesses:

GEO. T. PINCKNEY,
CHAS. H. SMITH.

T. A. EDISON.
Automatic-Telegraph.

No. 213,554.

Patented Mar. 25, 1879.

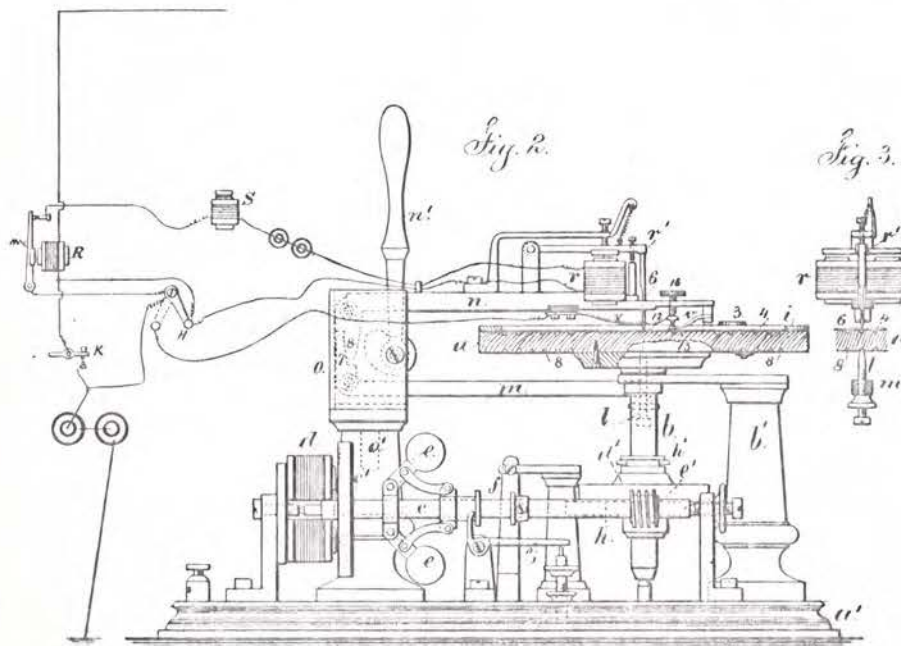


Fig. 3.

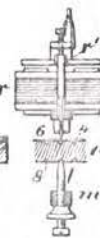
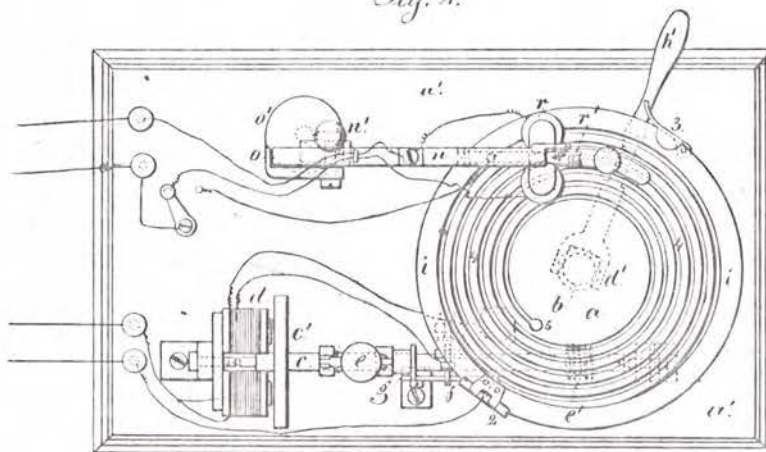


Fig. 1.



Witnesses

Charles Smith
Geo. T. Pinckney

Inventor

Thomas A. Edison.
per Samuel W. Lowell

Exh 6

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2 Sheets—Sheet 2.

T. A. EDISON.
Automatic-Telegraph.

No. 213,554.

Patented Mar. 25, 1879.

Fig. 5.

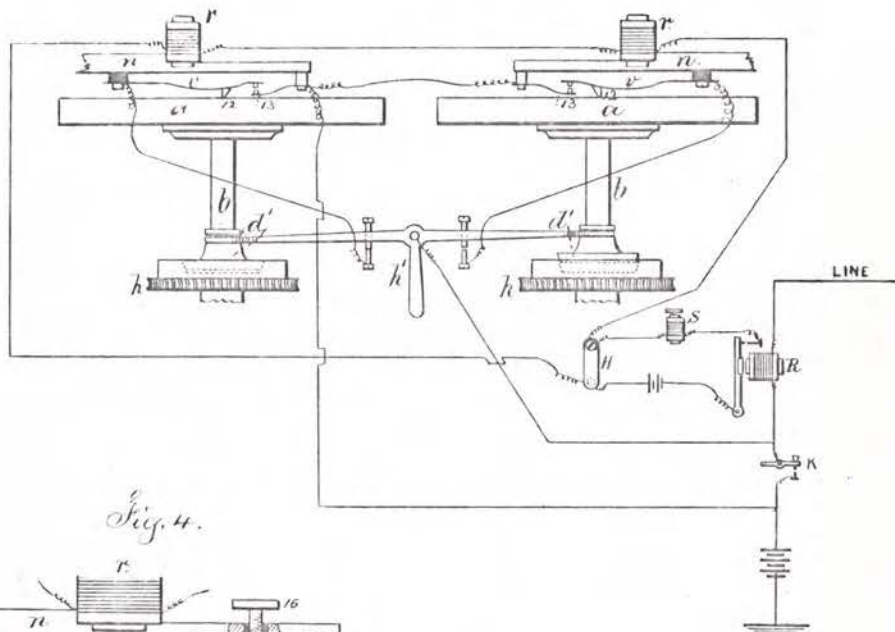


Fig. 4.

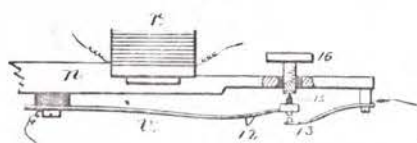
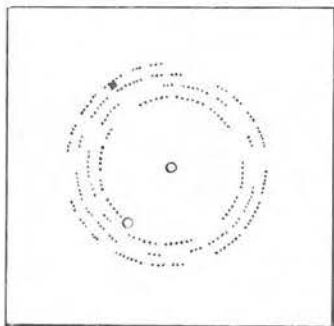


Fig. 6.



Witnesses
Charles Smith
Geo. T. Pinckney

Inventor
Thos. A. Edison
per Lemuel W. Ferrell atty

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

IMPROVEMENT IN AUTOMATIC TELEGRAPHS.

Specification forming part of Letters Patent No. 213,554, dated March 25, 1879; application filed March 26, 1877.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented an Improvement in Telegraphs, of which the following is a specification:

The object of this invention is to indent upon a sheet of paper the characters received from a distant station, or the characters transmitted from the same station, and to use such sheet of paper to transmit the same message, thus providing an automatic device for transmitting the same message more than once from one station to different stations, and for retransmitting the message automatically where it has to pass through several offices to reach its destination.

In the drawings, Figure 1 is a plan of the instrument. Fig. 2 is a side view with the indenting-plate in section; and Fig. 3 is a section of part of the indenting-plate and pin.

In chemical telegraphs a sheet of paper has been clamped to a disk, and the stylus resting upon such paper has been moved gradually toward or from the center of the disk by a volute groove in the surface of the disk itself or in a separate plate.

I make use of a volute groove in a disk or plate; but the first part of my invention relates to the disk or plate with volute groove or channel in the under-surface and the guiding-point below such plate, while the point that operates upon the paper is above that plate.

The disk or plate *a* is mounted upon the vertical shaft *b*, sustained by the standard *b'* and bed *a'*. Any suitable motor is applied to revolve the shaft *b* and plate *a*.

I have shown an electric engine consisting of the shaft *c*, armature *c'*, stationary magnets *d*, governor-balls *e*, circuit-breaker or commutator *f*, and lever-arm *g*, operated upon by the governor to open or close the local circuit to the magnets *d*, according to the speed of the engine, and thereby obtain uniformity. This electric engine is similar to that shown in my Patent No. 131,343.

The worm *e'* upon the shaft *c* serves to rotate the wheel *h* upon the shaft *b*, and there is a friction-clutch, *h'*, and lever *h''*, by means of

which the wheel *h* is connected with or disconnected from the shaft *b*.

Upon the plate *a* is a clamping-frame, *i*, preferably hinged at one side, 2, and provided with a swinging catch, 3, at the other side. The paper to receive the message is laid upon this plate *a*, and held by the frame *i'* around its edges.

There are to be guide-marks upon the paper and also upon the disk *a*, so that the paper can be correctly positioned upon the disk in the first instance, and replaced absolutely correct when required. For this purpose it is preferable to perforate the paper at the center and at a point corresponding to the hole 5.

The volute groove 8 is upon the bottom of the plate *a*, and in it is the point of the pin *l*, that is at the end of the arm *m*, and above the disk *a* and paper is the marking-point 6 at the end of the arm *n*.

These arms *m* and *n* are hinged to a stock, *o*, upon a vertical standard, *o'*, and there is a vertical pivot upon which the stock *o* and the lever-arms *m n* swing horizontally. The arms *m n* have right-angled toes, as seen by dotted lines at 7 and 8, and the weight of the arm *n* is greater than that of *m*, and hence the point *l* is raised up into the volute groove, and the point 6 rests upon the paper. The lever *n'* acts to raise the point 6 off the paper by pressing the lever-arm *m* downwardly when it is desired to move both points away from the paper.

The marking-point 6 is made to indent the paper by the action of the electro-magnet *r* and its armature-lever *r'*, and thereby produce Morse or other characters by pressing the paper down into the groove 4 of the disk *a*, and this electro-magnet *r* is either in the main line or (by preference) in a local circuit.

In Fig. 2 these circuit connections are illustrated. The relay-magnet *R* operates by its armature the local circuit to the electro-magnet *r*, and in this is placed the sounder *s*.

The operator at the receiving-station closes the switch *II* of his key *K*, and the sending operator opens his switch.

When the instrument is employed to translate or repeat the message into another circuit the delicate insulated spring circuit-closer *v*,

tracing point 12, and contact-point 13 are made use of, and these are placed in the circuit in order which the message is to be sent in order that the tracer 12 may lift the spring *c* and break the circuit when resting on the portion of paper that is not indented, and when the indented portion is beneath said point the spring closes the contact at 13, and the message is sent to the distant station.

The arrangement of circuits shown in Fig. 2 is convenient. In this the movement of the switch 11 to the dotted positions causes the main-line circuit to pass through the insulated spring circuit-closer *c*, point 13, arm *n*, so that the indented paper will give motion to the circuit-closer and transmit the message previously recorded.

The spring 13 rests upon the paper, and the circuit-closing spring *c*, carrying the point 12, has also the screw 15 to close the circuit upon the spring 13 when the indentation passes below the point 12. This screw 16 requires to be adjusted to suit the condition of the paper or of the indentations. I therefore provide a T-head to the screw, and a turner, 16, above it, which passes through the arm *n*, so that the adjustment can be made while the instrument is at work, the said turner being insulated and having a notch for the T-head of the screw, as shown in Fig. 1.

There may be two disks arranged to receive their motion from the prime mover, each having a friction-clutch that is operated by a double lever, *h'*, whereby one disk is disconnected and stopped simultaneously, or just after the other disk is put into motion, so that when one paper is full its disk may be stopped just after the other is started, so as not to drop any signals, and the paper that is full is removed and another paper substituted. The same devices are available either in receiving or in sending messages.

In the diagram, Fig. 5, the connections for this purpose are shown, and the lever *h'* closes the circuit through the spring circuit-closer *c* and contact-point 13 in the act of shifting the power from one of the disks to the other.

It will generally be preferable to make the volute grooves in square or oblong plates, so as to receive ordinary square or oblong sheets of paper. These can be more easily filed away for future reference, and contain the dates and facts desired upon the face of the paper, in the angles thereof. Fig. 6 shows one of these square blanks. The message can be read upon these blanks, or it can be repeated at any time.

In place of having only one contact spring and point, it may be preferable to have three, placed side by side and close together, so as to allow for any inaccuracy in the position of the paper, or that may result from expansion or contraction of the paper. Either one of these points passing into the indentation in the paper will close the circuit and transmit the signal. The screw 16 allows the contact-

points to be adjusted to suit the paper that is in use.

A puncturing or perforating point might take the place of the indenting or embossing point.

It is obvious that many modifications may be made to produce the same result. For instance, the electric engine may be replaced by a clock-work or other motor.

The arm *n* might be made to rotate instead of the plate *a*. The underneath spiral might be dispensed with, and the spiral on top of the plate might be continued out a greater distance from the center, and the additional spiral used for giving an outward movement to the arm. The plate itself might be dispensed with, and a drum used, with grooves cut lengthwise, and the indenting-magnet moved back and forward by suitable mechanism, the paper being fed from a continuous roll.

I am aware that it is not new to record telegraph-signals by indenting or embossing paper, as that method is adopted by Morse. Neither is it new to retransmit from such characters by causing them to give motion to contact mechanism, as that is shown in the English patent granted to William Thomson and Fleming Jenkin August 25, 1860, No. 2,047. Such embossing, however, was done on narrow strips of paper.

I claim as my invention—

1. In a telegraph in which the indented or embossed message is employed for transmitting electric pulsations, the means, substantially as specified, for recording the message in a volute line upon a sheet of paper, and for following that line with the circuit-breaking device in transmitting from such record, as set forth.

2. A plate provided with a volute groove upon its surface, and means for clamping a sheet of paper thereto, in combination with an indenting or perforating point, and means for maintaining the proper position of the point over the spiral groove, substantially as set forth.

3. A telegraphic blank of paper or similar material provided with one or more perforations, in combination with the plate receiving the same, and having corresponding marks to insure accurate adjustment in the various machines, substantially as specified.

4. The combination, with a spirally-grooved or volute plate, of an arm and indenting and transmitting mechanism supported by such arm, and a second similar groove for moving such arm, substantially as set forth.

5. In combination with a rest upon the paper, a point operated by the undulations of the surface of the paper and a circuit-closer and electric circuit to a distant receiving-instrument, substantially as set forth.

6. The arms *a* and *m*, pivoted to the stock *o*, and turning upon a vertical pivot, in combination with the plate *a*, containing a volute groove, substantially as specified.

7. In combination with two revolving plates

and the indenting or transmitting mechanism connected thereto, a clutch for connecting one plate before disconnecting the other, substantially as and for the purposes set forth.

8. The combination, with an indenting-instrument, electro-magnet, and spirally-grooved plate, of a sounder in the same circuit as the indenting-magnet, substantially as set forth.

Signed by me this 3d day of February, A.
D. 1877.

THOS. A. EDISON.

Witnesses:

GEO. T. PINCKNEY,
CHAS. H. SMITH.

U. S. C. C. E. D. of Pa.

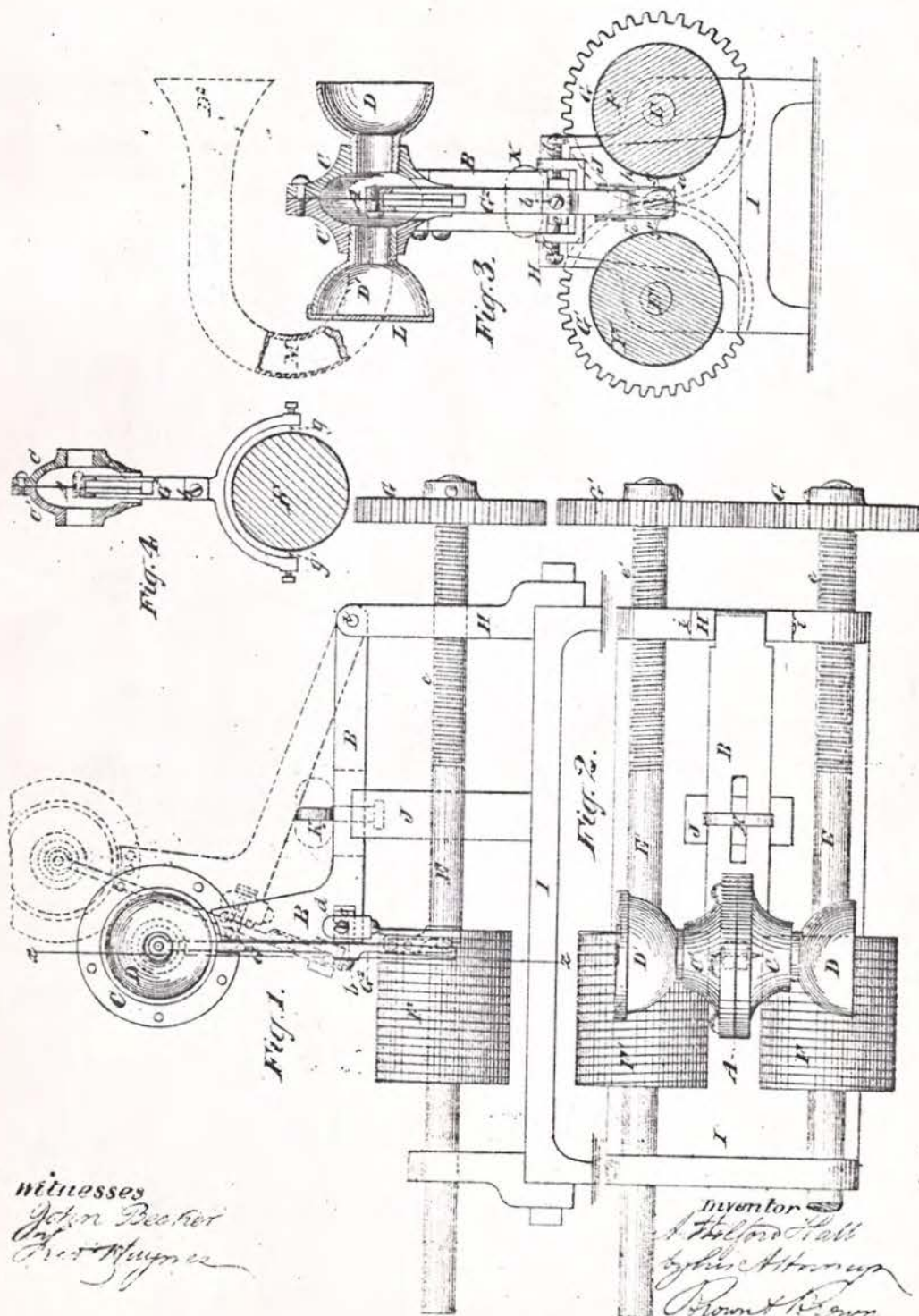
American Graphophone Co. vs. Berliner Gramophone Co. et als.
Defendants' Exhibit No. 5, U.S. Patent 219,939.
Sept. 23, 1879, Hall, Phonograph.

Samuel Bell
J. P. Esir

A. W. HALL.
Phonograph.

No. 219,939.

Patented Sept. 23, 1879.



witnesses
John Becker
H. H. Meyer

Inventor
H. H. H. H.
by H. H. H. H.
P. H. H. H.

UNITED STATES PATENT OFFICE.

A. WILFORD HALL, OF NEW YORK, N. Y.

IMPROVEMENT IN PHONOGRAPHS.

Specification forming part of Letters Patent No. 219,939, dated September 23, 1879; application filed November 29, 1878.

To all whom it may concern:

Be it known that I, A. WILFORD HALL, of the city, county, and State of New York, have invented certain new and useful Improvements in Phonographs; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

This invention consists in certain improvements in the phonograph which is the subject of Letters Patent No. 200,521, dated February 19, 1878, to Thomas A. Edison. In that instrument, as described by the patentee in the specification of his said Letters Patent, the sound-recording indentations or impressions produced on the tin-foil or yielding material are obtained by a single point and from one side only of the vibrating diaphragm, which is actuated by the sounds to be reproduced, and a single record only of the sounds is made, the indentations in such record being produced by the vibrations of the diaphragm in one direction only. Moreover, the vibration of the diaphragm is more or less restricted in consequence of the method of adjustment described in said Letters Patent, such adjustment having the effect of bringing a lateral tension on the diaphragm in one direction when the instrument is in its normal condition or at rest.

The objects of my invention are to provide for a more free vibration of the diaphragm, and to more fully utilize the vibrations of the diaphragm in both directions, both in the recording and in the reproduction of sounds, whereby I believe that several important advantages may be obtained, as will be hereinafter explained.

My invention consists, principally, in the combination, with the sound-recording or sound-reproducing diaphragm, of two points and one or more moving surfaces of yielding material, suitably arranged in connection with said points, whereby a divided record of the vibrations of the diaphragm is obtained and a double action is produced on the diaphragm for the reproduction of the sound—that is to say, in obtaining the record, one half is obtained from one point and from one side of the diaphragm by the vibrations of the diaphragm in one direction, and the other half is obtained from the other point and from the

other side of the diaphragm by the vibrations of the diaphragm in the opposite direction; and in the reproduction of the sound the vibrations of the diaphragm in one direction are produced from one half of the record, and those in the other direction from the other half of the record. By this means less depth of penetration of the points is required than when the record is made by a single point, and, as it is not necessary to put the diaphragm under a normal lateral tension in one direction, the diaphragm will vibrate in response to less atmospheric disturbance than when a single point and recording-surface are employed.

My invention further consists in the combination, with the diaphragm of a phonograph, of two mouth-pieces, one on each side thereof, whereby several important advantages are obtained, as will be hereinafter fully explained.

My invention also consists in several improvements of the details of construction of the instrument, as will be hereinafter fully specified.

Figure 1 in the accompanying drawing is a side view of a phonograph with my improvements. Fig. 2 is a plan of the same. Fig. 3 is a vertical section of the same in the plane indicated by the line *xx* of Fig. 1.

A is the diaphragm, which may be in any way suitably supported, but is represented as clamped between two internally-concave disks, C C', which are supported by a standard, B, and which are represented as fitted with separate tubes and mouth-pieces D D', one on each side of the diaphragm. A cap, L, is provided to fit and close either mouth-piece. It is shown in Fig. 3, placed on the mouth-piece D'.

E E' are two shafts arranged in suitable bearings below and parallel with the diaphragm, and carrying the two cylinders F F', upon which are to be secured the tin-foil or other yielding material upon which the record of the diaphragm is to be obtained. The said shafts have provided upon them screw-threads *e e'*, and one of the fixed bearings provided for each is provided with a corresponding female screw-thread, so that as the said shafts rotate they also have a longitudinal movement imparted to them by the act of rotation.

The said shafts are represented as geared together by gearing G G', to rotate at similar speeds but in opposite directions, and in order

that both shafts and cylinders may have corresponding longitudinal movements, one has a right-hand and the other a left-hand screw-thread.

The cylinders $F F'$ have each a helical groove provided in it of a pitch corresponding with the screw-threads on its respective shaft.

Between the diaphragm A and the cylinders $F F'$ there is attached to the standard B a lever, G^2 , the upper part of which is forked in such manner and shape, as shown in Fig. 3, as to pass through openings provided in the disks $C C'$, and embrace the diaphragm between the two limbs of its fork, which are so shaped as to clamp or bear upon opposite sides of the diaphragm near its center only, leaving the rest of the diaphragm free to vibrate under the influence of the sound-waves.

The lower part of the said lever is furnished with two points, $g g'$, which are so situated between or relatively to the two cylinders $F F'$ that one is capable of touching the tin-foil or other yielding material on one cylinder, while the other is capable of touching that on the other cylinder.

The said points are attached to the lever by means of elastic carriers $h h'$, or otherwise, in such manner as to be capable of adjustment to the requisite distance apart by means of a cam or eccentric, a , (see Fig. 3,) or other equivalent device attached to the lever for the purpose.

The fulcrum b of the lever is made adjustable in the standard B by being secured in a sliding block, c , which can be moved upon the standard in one direction or the other by means of adjusting-screws d, d' for the purpose of setting the lever, so that when the diaphragm and lever are at rest, and the points $g g'$ are at the proper distance apart, the said points may both just touch or press equally upon the yielding material on the two cylinders.

In order to provide for the removal of the lever and points from between the cylinders when it is desired to move the cylinders without producing any marks upon the yielding surfaces thereon, or when it is requisite to place, remove, or replace the tin-foil or other yielding material upon the cylinders, the standard B , upon which the diaphragm and lever are mounted, is pivoted at i to a stand, H , erected upon the supporting-base I of the instrument, so that the said standard, with the diaphragm and lever, can all be raised, as shown in dotted outlines in Fig. 1.

When the diaphragm and lever are in the operative position shown in Fig. 3, and in full outline in Fig. 1, the standard B rests upon a post, J , where it is then held down firmly by a button or set-screw, K .

The operation of the instrument in recording is as follows: The tin-foil or other yielding material upon which the record is to be obtained having been secured upon the cylinders, and the standard having been brought down and secured upon the post J to bring the points $g g'$ between the two cylinders, and

the cylinders having been so adjusted lengthwise, or the points so adjusted lengthwise, of the cylinders that one of the points is opposite to a groove in one cylinder and the other opposite to a groove in the other cylinder, the points are then adjusted so that each presses very slightly upon the foil or other material on one of the cylinders, and the shafts $E E'$ and cylinders $F F'$ are then set in motion by the clock-work or other motor provided for the purpose.

Either mouth-piece may be used; but the other one should be covered by the cap L , to prevent the neutralizing effect of air-waves passing around and acting upon the opposite side of the diaphragm to that which faces the open mouth-piece. Words spoken into the open mouth-piece then cause the diaphragm to vibrate, and the movements will be transmitted through the lever to the pins, and the vibrations will thereby be recorded by indentations in the foil or yielding material, one half of the record being obtained upon the material on one cylinder and the other half by indentations in the material on the other cylinder, each half of the record thus produced being the exact counterpart of the other half—that is to say, the indentations produced on the material on one cylinder being opposite the ridges left between the indentations of the material on the other.

The sound may be reproduced from either side of the diaphragm; but both sides may be utilized, and in order to provide for utilizing both sides the mouth-piece D or D' may be removed, and have a bent tube, M , and mouth-piece D^2 substituted for it, as shown in dotted outline in Fig. 3, so that the sound-waves produced on both sides of the diaphragm may be conducted in one direction.

In the operation of reproducing the sound, the vibration or movement of the diaphragm in one direction is produced by the half-record on one cylinder, and the vibration or movement in the other direction by the half-record on the other cylinder, the movements in both directions being produced in a positive manner with a velocity exactly proportioned to the velocity of the movements of the cylinders.

It is not absolutely necessary to employ two cylinders to produce the double or divided record. I have shown in the diagram Fig. 4 a construction of the lever and points whereby a single cylinder may be used, the lower end of the lever, to which the points $g g'$ are attached, being forked to so straddle or embrace the said cylinder that one point may act against or be acted upon by one side of the cylinder and the other point act against or be acted upon by the other side of the cylinder. In such case the cylinder should contain two helical grooves, the turns of each intervening between those of the other, and one of the points being arranged to press or touch the foil or other surface which is to receive the record opposite one of the said grooves, and the other to press or touch it opposite the other of said

grooves, so that the double or divided record may be produced on the one surface, but in distinct lines of indentations.

I have hereinbefore briefly alluded to some of the advantages resulting from this duplex system of recording and reproducing the vibrations of the diaphragm, but will now explain others of these advantages.

With a single point and a record produced from one side of the diaphragm only, the diaphragm in the reproduction of the sound can only be moved in one direction by the motion of the indented surface, swinging back in the other direction by its own normal vibration, and with a velocity only equal to its own vibrational number, which of course depends on its size, weight, and rigidity. Hence if the rotation of the cylinder should vary in speed from this normal vibrational rate, as it necessarily must do in producing tones of various degrees of pitch, it follows that a constant irregularity must occur between the rates of diaphragmatic vibrations in the two opposite directions, and this is what I believe to be the cause of the nasal intonation noticed in the single-acting instrument; but I believe that with the duplex system this defect will be remedied, as the two opposite indented surfaces driving the diaphragm positively with equal velocity in either direction in perfect alternation should reproduce the spoken words with the same intonation which formed the record.

The employment of the lever between the diaphragm and the recording-surfaces, besides obtaining the advantages hereinbefore mentioned, enables the diaphragm to be brought to a position above or out of the way of the recording part of the apparatus, and so enables both of its sides to be made available, as hereinbefore described, for reproducing the spoken words or sounds, thereby making the reproduction much louder than when the sonorous effect is produced from one side of the diaphragm only, as is unavoidable when the recording-point is arranged directly opposite to the diaphragm. Moreover, it is by placing the diaphragm in this position, out of the way of the recording apparatus, and permitting the tube or mouth-piece on one side of the diaphragm to be closed, that I prevent the neutralizing, hereinbefore mentioned, of sound-waves acting on the opposite side of the diaphragm to that against which a speaker's voice is directed.

By providing for the use of two mouth-pieces, one on each side of the diaphragm, and connecting them by tubes of suitable length with the diaphragm, two persons seated on opposite sides of the instrument may carry on a rapid and uninterrupted conversation.

Although the greatest advantages resulting from the use of a lever between the diaphragm and the recording-surface are obtained by the use of two points giving a duplex or di-

vided record, the advantage of leverage between the diaphragm and the recording-point would be considerable with a single point giving a single or undivided record.

I do not herein claim the combination, in a phonograph, of a diaphragm, a point, and a lever intervening between the diaphragm and the point.

What I claim as my invention is—

1. The combination, with the diaphragm of a phonograph, of two points connected with said diaphragm, and one or more moving surfaces adapted to be acted upon by or to act upon said points, substantially as herein described, whereby a duplex or divided record of the sound-vibrations is obtained or employed, substantially as herein set forth.

2. The combination, with the diaphragm of a phonograph, of two recording-surfaces, or surfaces having marks thereon corresponding with sound-vibrations, a lever connected with the diaphragm and having attached to it two points adapted one to operate upon or be operated upon by one of said surfaces, and the other to operate upon or be operated upon by the other of said surfaces, for the purpose of obtaining or employing a duplex or divided record, substantially as herein described.

3. The combination, with the diaphragm of a phonograph, of two cylinders adapted to carry yielding recording-surfaces, or surfaces having marks thereon corresponding with sound-vibrations, and a lever connected with said diaphragm and carrying two points, one of which is arranged to operate upon or be operated upon by the surface on one of said cylinders, and the other of which is arranged to operate upon or be operated upon by the surface on the other of said cylinders, substantially as and for the purpose herein set forth.

4. The combination, with the diaphragm of a phonograph, of two tubes and mouth-pieces, one on each side of the diaphragm, substantially as and for the purpose herein specified.

5. The combination, with the diaphragm of a phonograph and two mouth-pieces, one on each side thereof, of a cap adapted to fit and close either of said mouth-pieces, substantially as and for the purpose herein described.

6. The combination, with the diaphragm of a phonograph, of a mouth-piece communicating directly with one side of the diaphragm, and a bent tube communicating with the other side of the diaphragm and furnished with a mouth-piece presenting its opening in the same direction as the said directly-communicating mouth-piece, substantially as and for the purpose herein specified.

A. WILFORD HALL.

Witnesses:

FRED. HAYNES,
T. J. KEANE.

T. A. EDISON.
Phonograph.

No. 227,679.

Patented May 18, 1880.

Fig. 1.

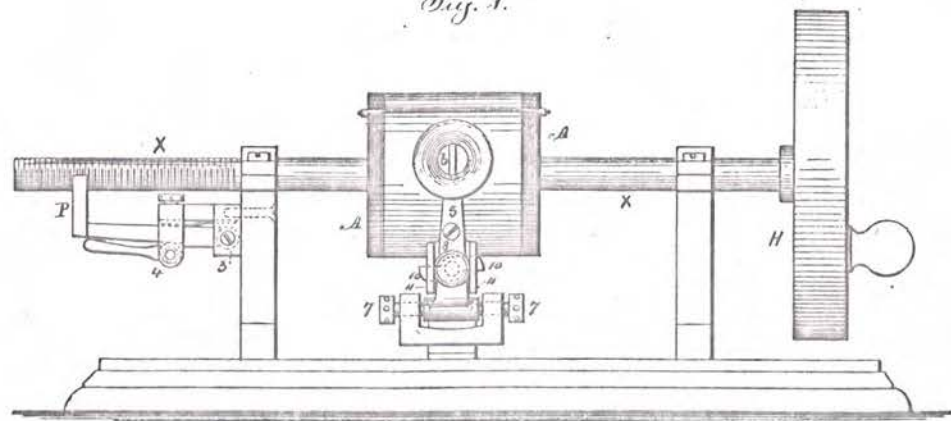


Fig. 2.

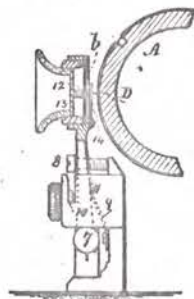


Fig. 5.

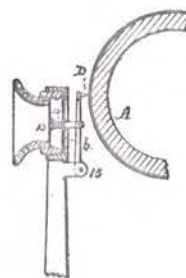
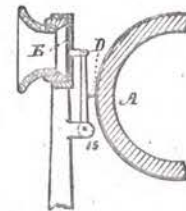


Fig. 6.



Witnesses.

Harold Serrell
Chas. H. Smith

Inventor

Thomas A. Edison
per Lemuel W. Serrell
attly.

T. A. EDISON.
Phonograph.

No. 227,679.

Patented May 18, 1880.

Fig. 4.

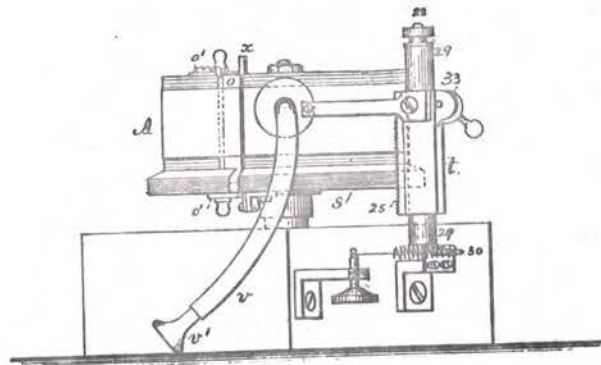


Fig. 3.

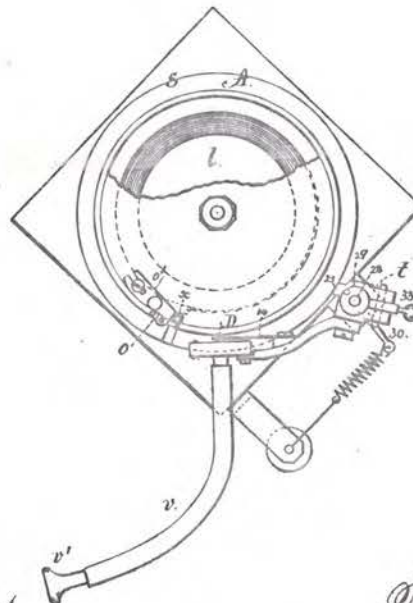
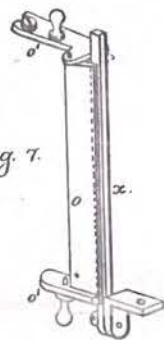


Fig. 7.



Witnesses:
Harold Sewell
Chas H. Smith

Inventor:
Thomas A. Edison
per Lemuel W. Spruell
att'y

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

PHONOGRAPH.

SPECIFICATION forming part of Letters Patent No. 227,679, dated May 18, 1880.

Application filed March 29, 1879.

To all whom it may concern:

Be it known that I, THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, have invented an Improvement in Phonographs, (Case No. 174,) of which the following is a specification.

In Letters Patent No. 200,521, granted to me, a cylinder with a helical-grooved surface is revolved with its screw-shaft and moved along endwise. Upon this cylinder there is a sheet of foil or similar material, and the same is indented by the action of a point moved by a diaphragm, and this foil forms a phonogram that can be used to reproduce the original sounds when moved in contact with a point and diaphragm. In the said patent one of the points is shown as connected directly to the diaphragm, and the other point is upon a spring.

My present invention relates to improvements upon the phonograph patented as aforesaid, and the features of such improvement are hereinafter specially pointed out.

In the drawings, Figure 1 is an elevation of the phonograph. Fig. 2 is a section of the diaphragm. Fig. 3 is an end view of the cylinder containing the foil. Fig. 4 is a side view of the diaphragm and the device for moving the same.

The cylinder A has a grooved surface, as in aforesaid patent; and it receives the tin-foil or other material that is to be indented by the action of the diaphragm b and point to produce the record of the sound, which I term the "phonogram," and the diaphragm E and point D are adapted to form a phonet and reproduce the sound; but it is to be understood that the same point and diaphragm may be employed to record and to reproduce the sound.

In my present invention, as in my former patent, the motion of the recording-surface may be derived from clock-work, hand, or other power.

In order to insure great uniformity of speed and prevent irregularity in the movement by inaccuracies of work, dust, lack of oil, or any other source of local friction or resistance, I make use of an abnormally heavy fly-wheel,

H, upon the shaft of the phonograph, so as to prevent any trembling movement and to resist any tendency to increase or lessen the speed, for upon uniformity of speed of the phonet with the phonograph depends the accuracy of reproduction, especially in musical sounds, that depend for their tone upon the number of vibrations per second.

The nut P is upon a lever pivoted at 3 and kept in contact by a cam, 4. When this lever and nut P are lowered the shaft X and cylinder A can be slipped endwise.

The arm 5, carrying the diaphragm b, should be pivoted at 7 7 by pointed screws, so as to adjust the position of the recording-point of the diaphragm b relatively to the grooves of the cylinder. The screw 8 determines the position to which the diaphragm and recording-point may approach to the cylinder. The spring 9 serves to move the arm 5 away from the cylinder, and the double-ended locking-piece 10, entering slots in the frame 11, holds the arm in place when in use.

One of the peculiarities of the present invention over the aforesaid patent is a spring, 12, of india-rubber or other suitable material, placed between the cross-bar or bridge 13 and the diaphragm, that serves as a damper to prevent false vibrations of the diaphragm and cause it to respond only to the actual movement given by the phonogram through the point D. It is also usually preferable to employ a spring, 14, between the point and the diaphragm. This is useful, in both the phonograph and the phonet, to prevent false sounds. This spring and diaphragm I have used in connection with telephones. I do not, therefore, herein lay claim to the same, broadly. I have combined the same with the recording or phonet point and the phonogram.

Another feature of invention relates to a lever between the diaphragm and the phonogram, whereby the relative movements of the parts may be varied. This lever e has a fulcrum at 15. If the connection to the diaphragm is between the point D and fulcrum 15, as in Fig. 5, then the motion of the point will be greater than the diaphragm, and when used in the phonograph will amplify the indentations

in the foil. If used in the phonet, the movement of the diaphragm would be lessened. I therefore prefer, in that instrument, to change the places of the point and diaphragm connection, as shown in Fig. 6, so as to amplify the movement of the diaphragm and increase the sound.

Another feature of my present invention relates to the foil-holder, which I place on a reel within the cylinder A, and draw the same out through a slot, as required from time to time, thus preserving the foil from injury and rendering it unnecessary to handle the same.

The reel *l* within the cylinder A is adapted to receive the foil in a roll upon it. One head of the cylinder is removable, so as to allow of the insertion or withdrawal of the reel. There is a slot in the cylinder, through which the foil is brought out, and there is a bar, *o*, forming part of the periphery of the cylinder, that is connected at its ends to the slides *o'*, (see Fig. 7,) one at each end of the cylinder, and there is a lever-bar, *x*, behind this slide-bar *o*. When the slide *o'* is drawn back from over the lever *x*, such lever can be swung out of the slot in the cylinder A, and the foil can be drawn out of the slot and wrapped around the cylinder, and then the end is placed behind the bar *x*, and carried by it into the slot of the cylinder, and then the slide *o'* is moved so that its edge passes over the lever *x*, and in so doing the foil is tightened around the cylinder and the lever *x* held in place. The surface of this cylinder is made with a helical groove, and the rim *s* of the cylinder is made with a similar screw or groove, and the sliding sleeve *t*, that carries the diaphragm-arm, has a screw-surface at 25, that comes into contact with the screw *s*.

With this character of instrument it is preferable to have the cylinder A upon a vertical shaft, and the sleeve *t* and diaphragm will be moved vertically. For this purpose the fixed stud 28 is vertical, and upon it is a tube, 29, of a size to receive the sleeve *t*, and having a groove and key, by which the sleeve *t* is allowed to slide endwise of the tube 29; but the two can be turned together on the stud or shaft 28. An arm, 30, on the tube 29, and a spring, serve to turn the tube, the sleeve, and the diaphragm and arm with sufficient force to bring the point D to bear upon the foil with the required force.

It is preferable to employ with the diaphragm a tube, *v*, and mouth-piece *v'*, such tube being flexible.

The speaking into and recording of the sounds in the phonograph will be proceeded with as usual, and the reproduction of the sounds will be as before; but in case the operator wants to suspend the recording in the phonograph or the speaking in the phonet he simply has to draw upon the flexible tube, which swings the parts so as to disconnect the screw-rack from the flange *s* of the cylinder.

This at the same time moves away the recording or the phonet point. The cylinder A can continue to revolve, and when the operator is ready he releases the pull upon the flexible tube, and the parts commence to act again at the exact place where the operation was suspended, because the screw-threads will only drop together when the proper part of the thread *s* comes to the corresponding part on the rack 25.

I employ the cam 33 and its lever upon the sleeve *t* to act upon the tube 29 and prevent the sleeve falling when the screw-threads are disconnected. This cam-lever 33 is self-acting, and it has to be raised when the sleeve *t* is to be lowered, so as to recommence at one end of the cylinder A.

By simply turning the sleeve and moving the diaphragm and the screw-surface back, the sleeve and diaphragm can be slipped endwise to any desired place upon the cylinder A to receive or deliver sounds.

I am aware that fly-wheels are employed in numerous ways for equalizing the speed of machinery. I do not claim the same, broadly. In experimenting with my phonograph I discovered that the reproduction of the sound was imperfect if the slightest variation occurred in the speed; hence the combination with the cylinder of a very heavy fly-wheel in proportion to the cylinder rendered perfect and reliable the action of the instrument in receiving and reproducing the sound by equalizing the speed.

I claim as my invention—

1. The combination, with the phonograph cylinder, shaft, and screw-surface, of a swinging nut or screw-surface, to connect or disconnect the parts that keep the recording or phonet point in position relative to the groove of the cylinder, substantially as set forth.

2. In combination with foil or a sound-recording surface, a point, a diaphragm, and a spring or damper acting to press the diaphragm toward the point, substantially as set forth.

3. In combination with a foil or sound-recording surface, a point, a diaphragm, and a spring between the point and the diaphragm, substantially as set forth.

4. The combination, in a phonograph or phonet, of a diaphragm, a point, and a lever intervening between the diaphragm and the point, substantially as set forth.

5. The combination, with the spirally-grooved cylinder in a phonograph, of a reel within the cylinder carrying the foil or similar recording material, a slot in the cylinder, through which the foil is led out, and means for clamping the foil, substantially as set forth.

6. The combination, with the cylinder A, of the sliding bar *o* and lever *x*, to clamp the foil and stretch the same, substantially as set forth.

7. The swinging sleeve *t*, having an arm that carries the diaphragm, in combination with the cylinder *A*, and rim *s*, having a screw-thread surface, substantially as set forth.
8. The tube 29 upon the fixed stud 28, in combination with the sliding sleeve *t*, the diaphragm, and the cylinder *A*, substantially as described and shown.

Signed by me this 19th day of March, 1879.

THOMAS A. EDISON.

Witnesses:

S. L. GRIFFIN,
WM. CARMAN.

U. S. C. C. E. D. of Pa.

American Graphophone Co. vs. Berliner Gramophone Co. et als.

Defendants' Exhibit, No. 7, U. S. Patent 283,665,

Aug. 21, 1883, Rogers, Automatic Telegraph.

James P. Rogers
Spec. Agent

7

(No Model.)

2 Sheets—Sheet 1.

J. W. ROGERS.
AUTOMATIC TELEGRAPH.

No. 283,665.

Patented Aug. 21, 1883.

Fig. 1.

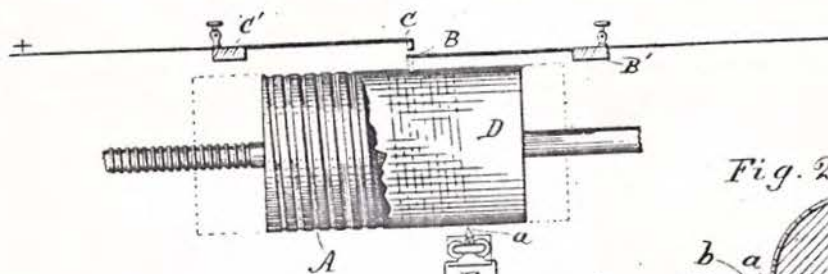


Fig. 2.

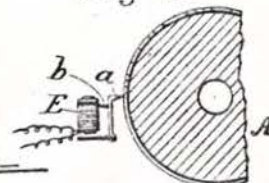


Fig. 3.

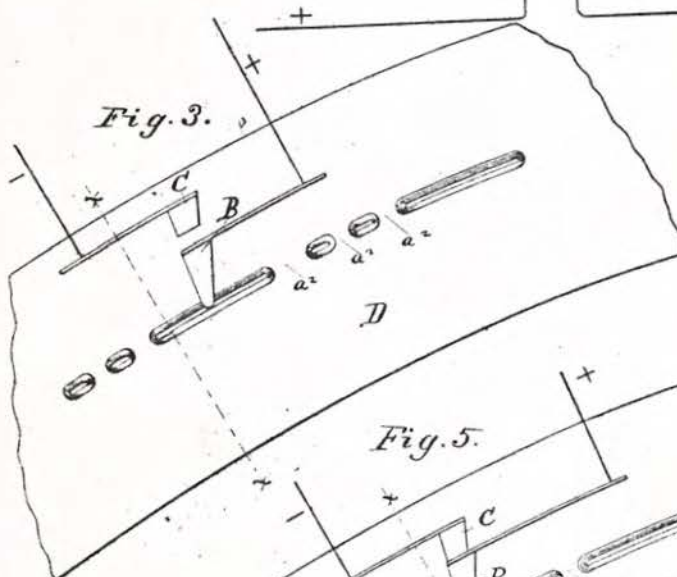


Fig. 4.

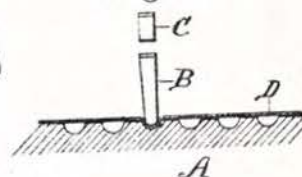


Fig. 5.

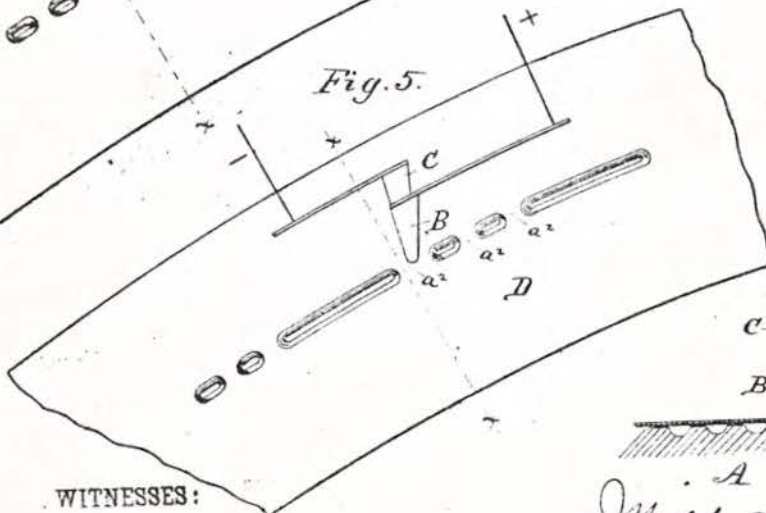
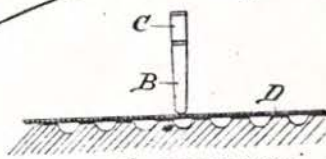


Fig. 6.



WITNESSES:

Thos. Houghton.
Edw. W. Ryan

A INVENTOR:

J. Webb Rogers

BY Wm. L.

ATTORNEYS.

(No Model.)

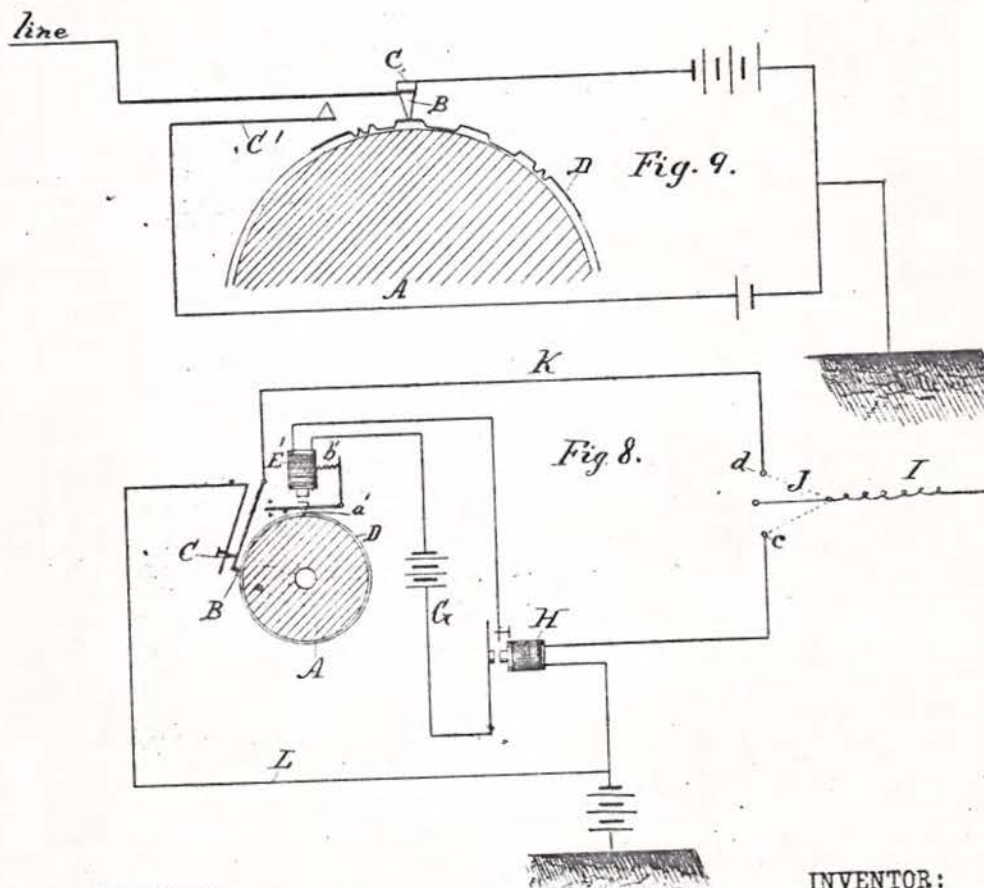
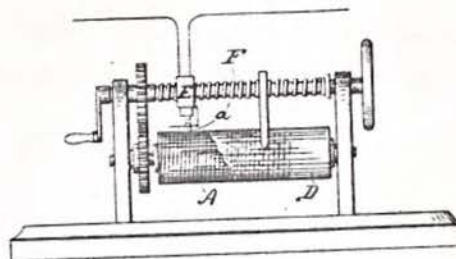
2 Sheets—Sheet 2.

J. W. ROGERS.
AUTOMATIC TELEGRAPH.

No. 283,665.

Patented Aug. 21, 1883.

Fig. 7.



WITNESSES:

Thos. Houghton.
Edw. W. Byrne

INVENTOR:

J. Webb Rogers
BY *Wm. L.*
ATTORNEYS.

UNITED STATES PATENT OFFICE.

JAMES WEBB ROGERS, OF NEW YORK, N. Y.

AUTOMATIC TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 283,665, dated August 21, 1883.

Application filed May 3, 1883. (No model.)

To all whom it may concern:

Be it known that I, JAMES WEBB ROGERS, of New York, in the county of New York and State of New York, have invented a new and useful Improvement in Automatic Telegraphs; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side view of the cylinder with a portion of the indented jacket broken away, and showing the position of the indenting-relay and the traversing stylus. Fig. 2 is a cross-section of the cylinder, showing the relation of the indenting-relay thereto. Figs. 3 and 5 are exaggerated views in perspective, showing how the circuit is made and broken by the indentations and alternating spaces. Figs. 4 and 6 are cross-sections, Fig. 4 being taken through line *x x* of Fig. 3, and Fig. 6 being through line *x x* of Fig. 5. Fig. 7 is a side view of a modification of my invention. Fig. 8 shows a diagram of circuits for the same, and Fig. 9 shows means for avoiding tailings or static change on the line.

My invention relates to an automatic telegraph designed for rapid transmission and easy repetition of messages. It is founded upon the following general principles of construction, which are already known and made use of, viz: an indented fillet or sheet of paper or other non-conducting material, which, when passed under a movable terminal of an electric circuit, is made to actuate mechanically the said terminal to alternate contact and separation from the other terminal as the indentations successively pass under the movable terminal for the purpose of alternately opening and closing an electric circuit.

My invention consists in the combination of a spirally-grooved cylinder having a rotary motion, a jacket or strip of paper or other indented material having indented characters therein and wrapped around said cylinder, and two terminals of an electric circuit, one of which is movable and is actuated to intermittent contact with the other terminal by traveling on the normal or plane surface of the paper, and separates from the other terminal

by falling into the indentation in said strip of paper, the traverse of the groove by the movable terminal being effected either by the endwise movement of the cylinder or the movement of the terminals parallel to the axis of the cylinder, as hereinafter fully described.

In Fig. 1 of the drawings, A represents a cylinder having on its periphery a spiral groove, and having upon one of its journals a spiral thread of a pitch exactly equal to that of the spiral groove on the periphery of the cylinder, so that when the journal of the cylinder is fitted in an interiorly-threaded bearing and the cylinder is turned the cylinder has an endwise progressive movement in a right line, so that a relatively-stationary stylus on the periphery of the cylinder is made to traverse the groove therein.

B is a stylus, which is sustained by a spring mounted on the fixed support B', and C is a stationary anvil attached to a spring immediately above the stylus, and mounted upon a fixed support, C'. This stylus and anvil constitute the two terminals of an electric circuit, as shown.

D is a jacket, sheet, or strip of paper, or other indented non-conducting material, which is simply fastened about the periphery of the cylinder. This jacket is indented into the groove of the cylinder with Morse characters, by means of an indenting-point, *a*, worked by a relay, E, the said point being mounted upon one arm of an elbow-lever, as in Fig. 2, while the other arm carries the armature of the relay, and the relay serving to throw the point against the periphery of the cylinder, while a spring, *b*, withdraws it therefrom. This relay is worked by a Morse key in an independent circuit.

Now, for recording a message on the paper jacket and transmitting it the following is the method of working: The circuit of the relay is made and broken by the key in the usual way, either close at hand or at a remote point, and the relay is made to project the point against the paper jacket of the cylinder in accordance therewith, and as the cylinder rotates its groove in passing under the point of the relay permits the latter to indent a spiral row of Morse characters in the said paper

around the cylinder. Then, after the record has been thus made on the cylinder, the latter is run back, so that the beginning of the row of characters is under the stylus B, and the cylinder being now rotated and progressively moved under the stylus, the alternate indentation and intervening flat spaces cause the stylus to be alternately projected into contact with the anvil C of the other terminal, thus making and breaking the circuit in accordance with the record made. Thus, when the stylus drops down into an indentation, as in Figs. 3 and 4, the stylus B leaves the anvil C and breaks the circuit, and when the stylus rides up on the space intervening between the indentations and lying in the normal plane of the paper strip or jacket, as in Figs. 5 and 6, the stylus B is projected into contact with the anvil and completes the circuit.

This apparatus permits a message to be made and then transmitted without removing the paper from the place where its message is recorded, and makes a very desirable form of repeater, as the message recorded on the cylinder A may be received by the relay E from a distant station, and then, when transmitted through the stylus and anvil B and C, is sent to another distant station in an easy and practical manner, without mistake and without the aid of an expert.

In Figs. 7 and 8 is shown another form of my invention, in which the cylinder does not have an endwise motion, but simply revolves, while the relay with indenting-point and the transmitting-stylus and its anvil have a right-line movement parallel to the axis of the cylinder in traversing the groove of the same. For this purpose the indenting-relay and the transmitting-stylus are hung upon a screw-threaded counter-shaft, F, arranged parallel to the axis of the cylinder, and the screw-threads of which counter-shaft have such pitch that when the cylinder and counter-shaft are geared together by wheels, as shown, the rate of rectilinear progression of the relay, and the stylus on the counter-shaft is exactly the same as that of the groove of the cylinder, so that when the cylinder revolves the stylus will traverse the groove from end to end. In this modification the indenting-point a' of the relay is forced inwardly to the cylinder by the spring b' , and is drawn away from it by the relay, which is here shown in a local circuit, G, closed by the relay H. The main line I is also provided with a switch, J, which, when thrown on the point c , causes the main-line impulses to pass through relay H to ground, and by closing the local circuit operate the indenting-relay E. When the switch J is resting on the point d , relay H is cut out and the instrument is ready for transmitting, and as the cylinder revolves the stylus B, rising and falling in response to the indentation, alternately makes and breaks the circuit between I K B and C L.

Now, I am aware that it is not new to cause indentations in a piece of paper to actuate a

movable terminal to intermittent contact with another terminal when said paper was disposed as a flat plane and the indentations were arranged as a volute spiral. On the other hand, I am aware that a spirally-grooved cylinder has been provided with an indented tin-foil jacket, in which the tin-foil formed one of the terminals of the electric circuit. The objection to the first arrangement is that a volute spiral lying in the same plane makes a constantly-varying rate of travel, which is overcome in a spirally-grooved cylinder, and the distinction with respect to the second arrangement disclaimed is that when indented tin-foil constitutes one of the terminals the transmitting-stylus has to be carried with very great accuracy to prevent it from touching either the bottom or sides of the indentations, whereas with my invention, where a non-conducting sheet is used, the stylus may continually bear upon the paper and touch the sides and bottom of the indentations without risk of making a closure of the circuit.

Another advantage of my invention is (see Figs. 5 and 6) that when the stylus B is projected up to contact with the anvil C considerable lifting effect is required, and it will be seen that this lift is effected by the straight or plane surface of the paper at $a'' a''$, which paper is distended over a groove, as in Fig. 6, like a miniature suspension-bridge, and this lifting action is much more positive than would be obtained from an embossment, which, being narrow, would be crushed down by the weight of the stylus and the tension of its spring, and fail to make electrical contact above.

It is obvious that instead of using a non-conducting jacket for the cylinder a jacket of conducting material might be used, since its only function is a mechanical one, and not that of conduction.

For preventing induction on the lines or avoiding tailings or static change, currents of reversed polarity may be thrown upon the line alternately with the main impulses, as has been heretofore done. Thus, in Fig. 9, the stylus B, when elevated by the spaces between the indentations, makes contact with the terminal C of main battery, and when an indentation comes under the stylus the latter drops away from contact with C and makes contact with C', which is the terminal of a smaller battery of reversed polarity.

In defining my invention more clearly with respect to Edison's Patent No. 213,554, I would state that in the latter the modification referring to the use of a cylinder is substantially different from my construction, in that the cylinder is grooved longitudinally and not spirally, as in mine, and the cylinder is not the permanent carrier of the paper jacket, but the paper simply passes over the same tangentially from a separate roll. I therefore confine this part of my invention to the spirally-grooved cylinder and the permanent peripha-

al indentable jacket, in which the paper or indentable covering is not required to be removed from the cylinder between the time of making the record and transmitting it and the registration of the indented record with the subjacent grooves is preserved with accuracy and with the expenditure of no skill or labor.

With respect to the method of transmitting the electric impulses, Edison's tracer or stylus lifts the spring and breaks circuit when the tracer is passing over the surface of the paper not indented. In my method just the reverse takes place—i. e., the tracer or stylus makes or completes the circuit when the tracer or stylus is on the portion of the paper not indented. When the tracer, stylus, or movable terminal makes contact by descending into the grooves and striking against the other subjacent terminal, the said movable terminal must have an invariable or uniform and definite range of movement in descending in order to strike the subjacent terminal, and sometimes the movable terminal or stylus will (by wedging against the sides of the grooves or indentations in the paper when they are not wide enough, or striking against the bottom when they are not deep enough) fail to have that range of downward movement necessary to bring it into certain contact with the lower terminal, and the result is that the circuit is not closed when it should be. It is not possible to guard against this contingency by adjusting the lower terminal to a closer position to the movable terminal, because of the variable character of the grooves or indentations as to width and depth caused by the contraction of the paper after the grooves or indentations are made. Where, however, the circuit is closed by the elevation of the movable

terminal against a superposed stationary terminal by the pressure of the non-indented surface or normal plane of the paper, a certain and positive closure of the circuit is obtained, because the normal plane of the paper always projects the movable terminal a fixed, uniform, and determinate distance, and the stationary terminal above may be adjusted to a position that insures contact and the closure of the circuit each time the movable terminal is lifted by the normal plane of the paper. Furthermore, in my case, as the opening of the circuit is made by the initial movement of the movable terminal in falling into the indentation, it matters not, for this action, whether the movable terminal moves a uniform distance or not.

Having thus described my invention, what I claim as new is—

The combination of a cylinder having a spirally-grooved periphery, a jacket having characters indented therein below the normal plane of the jacket, and two terminals of an electric circuit arranged upon the indented side of the jacket, and one of which is made movable and traverses the route of the indentation, the said movable terminal being thrown into contact with the other terminal by the non-indented portion or normal plane of the paper, and the said terminals and cylinder having a motion one over the other, as described.

The above specification of my invention signed by me in the presence of two subscribing witnesses.

JAMES WEBB ROGERS.

Witnesses:

EDW. W. BYRN,
SOLON C. KEMON.

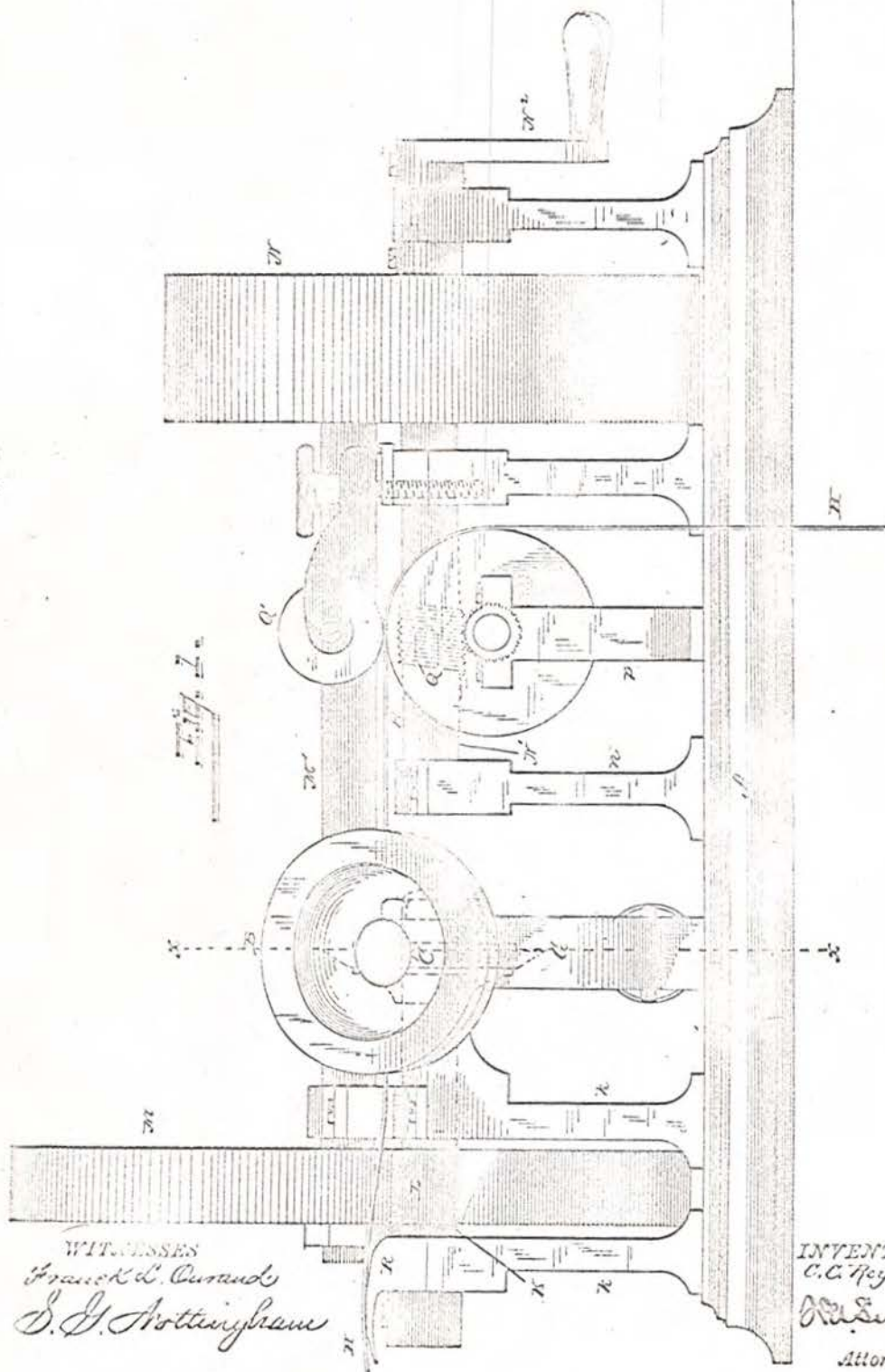
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5 Sheets—Sheet 1.

C. C. REYNOLDS.
PHONOGRAPH.

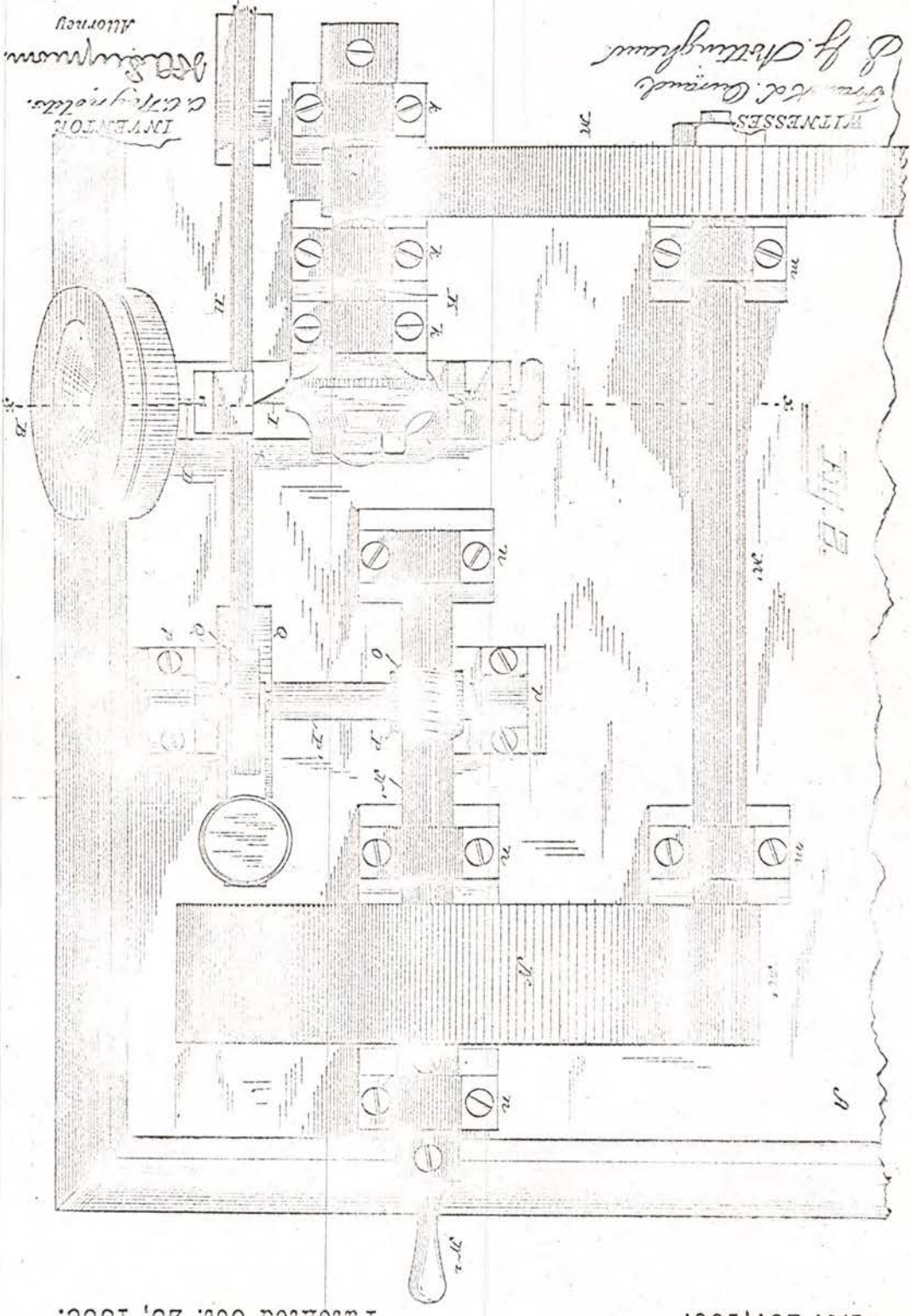
No. 237,166.

Patented Oct. 23, 1883.



WITNESSES
Frank L. Curandy
D. J. Nottingham

INVENTOR
C. C. Reynolds.
W. J. S. S. S.
Attorney



INVENTOR
C. C. Reynolds.
Attorney

WITNESSES
J. H. Chittenden
J. H. Chittenden

THE AMERICAN PATENT PHOTOGRAPH CO. PHOTOGRAPHY, WASHINGTON, D. C.

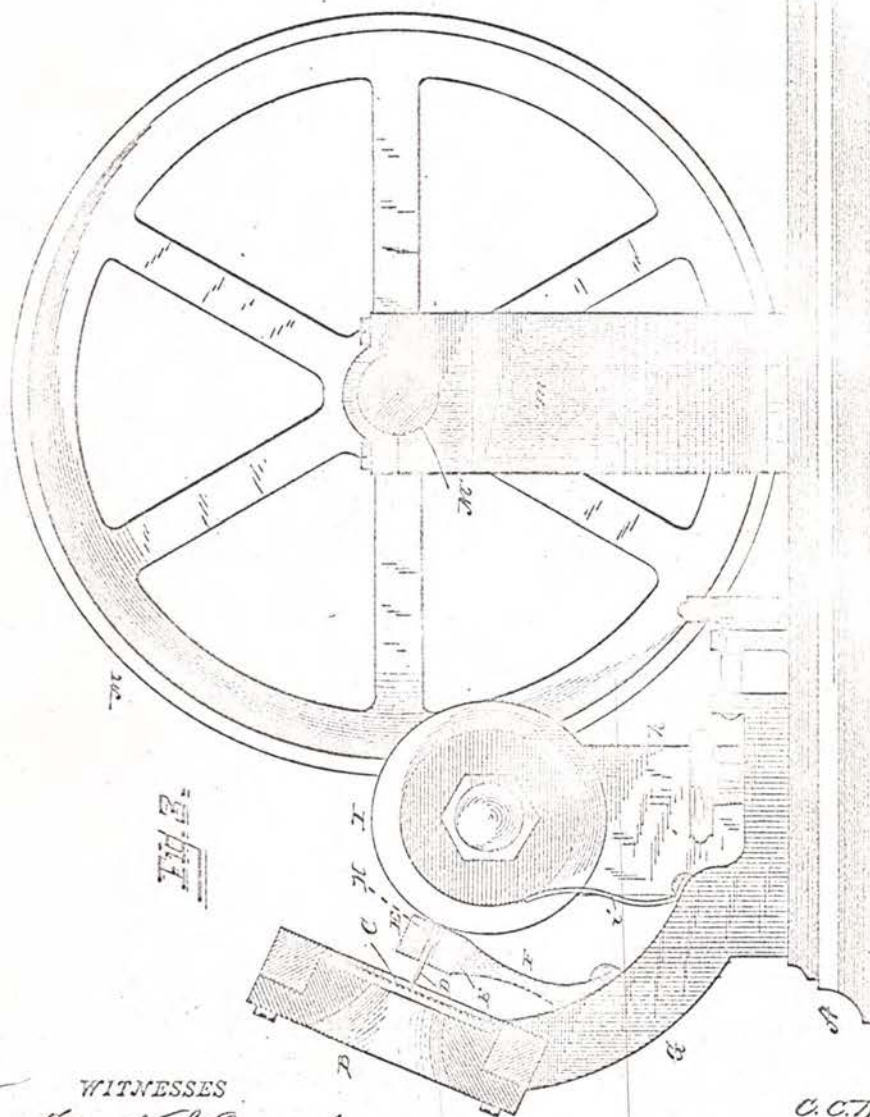
(No Model.)

C. C. REYNOLDS.
PHONOGRAPH.

5 Sheets—Sheet 3.

No. 287,166.

Patented Oct. 23, 1883.



WITNESSES

Frank L. Curran
S. J. Nottingham

INVENTOR

C. C. Reynolds.

W. S. Symon.
Attorney

(No Model.)

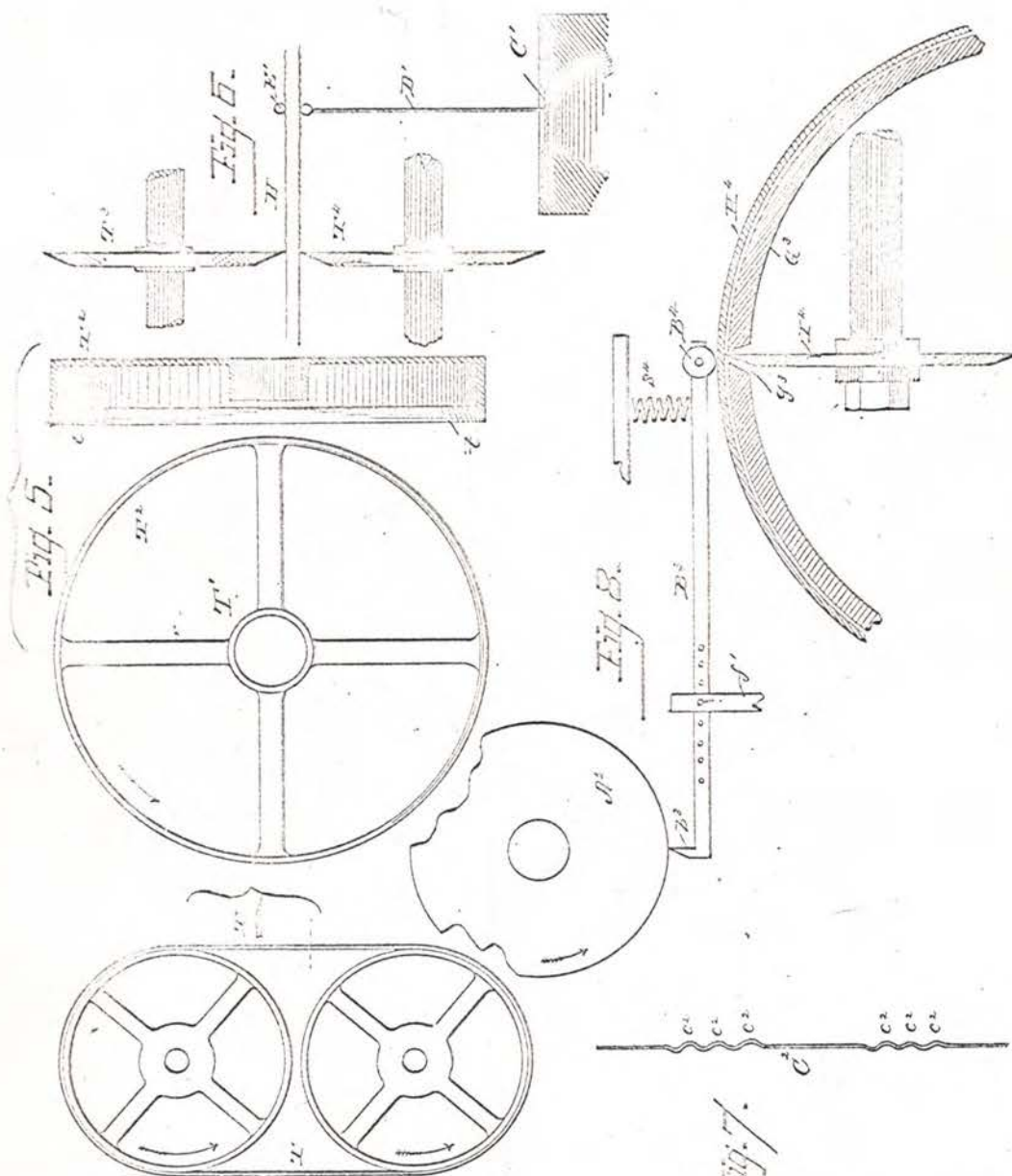
5 Sheets—Sheet 4.

C. C. REYNOLDS.

PHONOGRAPH.

No. 287,166.

Patented Oct. 23, 1883.



WITNESSES
Frank L. Curand
S. J. Nottingham

INVENTOR
C. C. Reynolds.
J. A. Simpson.
Attorney

C. C. REYNOLDS.

PHONOGRAPH.

No. 287,166.

Patented Oct. 23, 1883.

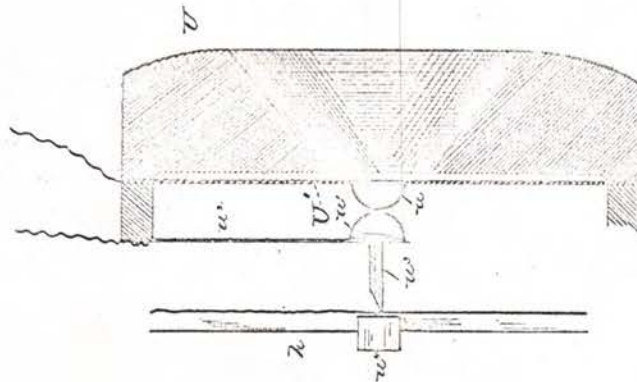


Fig. 9.

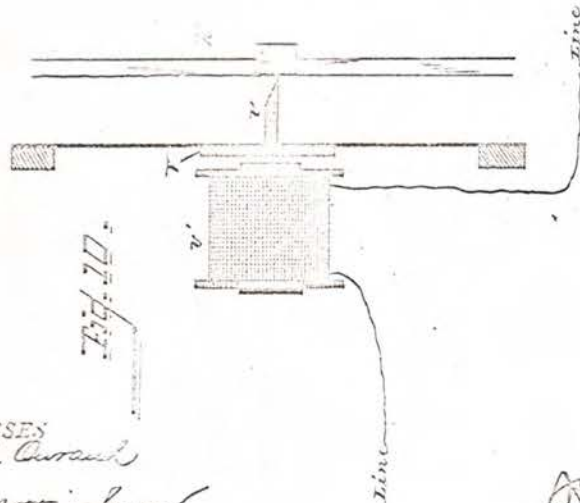


Fig. 10.



Fig. 11.

WITNESSES
Frank L. Cross
S. J. Nottingham

INVENTOR
C. C. Reynolds.
W. A. Symmes.
Attorney

SPEC

To all
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and Tex
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t. 23, 1883.

UNITED STATES PATENT OFFICE.

CHRISTOPHER C. REYNOLDS, OF PRESCOTT, ARIZONA TERRITORY.

PHONOGRAPH.

SPECIFICATION forming part of Letters Patent No. 287,166, dated October 23, 1883.

Application filed May 23, 1883. (No model.)

In all whom it may concern:

Be it known that I, CHRISTOPHER C. REYNOLDS, of Prescott, in the county of Yavapai and Territory of Arizona, have invented certain new and useful Improvements in Phonographic Instruments; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in phonographic instruments, and methods by which are produced permanent records of sounds in such form that the sounds may be reproduced through the instrumentality of the records.

Instruments of this class as heretofore constructed have produced the sound-record by embossing or indenting a sheet of tin-foil or similar thin and pliable material, which is supported upon a revolving cylinder or plate to receive the action of a recording-stylus, which is forced directly against the sheet by a diaphragm vibrating in response to sounds, the said cylinder or plate being grooved spirally in order to permit the record-sheet to be forced into the groove to raise the record on one side of the sheet, while it is sunken or indented on the other side. The disadvantages of such an instrument are as follows: First, its capacity for continuous recording is limited by the dimensions of the cylinder or plate which supports the record-sheet; second, removing the sheet from its supporting plate or cylinder destroys the perfection of the record, as the embossing becomes more or less disarranged or obliterated as the thin and soft sheet is subjected to the handling and bending necessarily incident to its removal; third, the embossing is so delicate and fragile that it is distorted by the action of a stylus, with which it is moved in contact for the purpose of reproducing the sounds, and consequently the reproduction is not exact; and, fourth, the resistance which the record-sheet opposes to the recording-stylus prevents the diaphragm from having an amplitude of vibration commensurate with the force of the sound-waves projected against it; and therefore the reproduction will not have the volume or loudness of the original sounds.

It is the object of my invention to provide a phonographic apparatus which is not subject to the disadvantages above enumerated; and to this end it consists in a new method and certain novel constructions and combinations of devices, which will be clearly understood from the following particular description, in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of a phonograph constructed according to my invention. Fig. 2 is a top view thereof. Fig. 3 is a section on the line *xx*, Figs. 1 and 2. Fig. 4 is a view in elevation and diametric section of a modified form of the record-cutter. Fig. 5 is a view in elevation and section of another modification of the record-cutter. Fig. 6 is a plan view of a portion of an instrument adapted to cut the record on both sides of the record-strip. Fig. 7 is a diametric section of a form of diaphragm adapted for use in my improved phonograph. Fig. 8 is a diagram illustrating the construction of an instrument for copying and amplifying an original record made by the old forms of instruments. Fig. 9 is a section of a portion of a telephonic-transmitter adapted for transmitting signals in connection with a record-strip produced by my improved instrument. Fig. 10 is a diametric section of another form of telephonic-transmitter adapted for operation by the record-strip; and Fig. 11 is a view in cross-section of various forms of strips which may be used to receive the record.

In the drawings, the letter A indicates a base-board, upon which the various parts of my phonograph are mounted.

B is a mouth-piece, in which is secured a diaphragm, C, in the manner usual in such instruments, and from the center of this diaphragm projects a stem, D, corresponding to the stylus of the ordinary phonograph. The outer end of this stylus plays between two guides, E E, supported by an arm, F, which projects from the adjustable standard G, which carries the mouth-piece. These guides E are arranged to receive between them the traveling record-strip H, which is guided across the edge of a rotary cutter-plate, I, which is carried by a shaft, K, mounted in bearings at the tops of standards L, rising from the base-board. Said shaft has also fixed upon it a friction-

INVENTOR
Christopher Reynolds.

Attorney

wheel, L, which is driven by a larger friction-wheel, M, carried by a shaft, M', supported by standards m, and carrying at its opposite end a friction-pinion, M'', which is driven by a main driving friction-wheel, N, carried by a shaft, N', which rotates in bearings on standards n. This shaft N' is provided with a worm-gear, o, which meshes with a tooth-pinion, P, mounted on a transverse shaft, P', supported by standards p, and having fixed upon it a friction feed-wheel, Q, over which passes the record-strip H, said strip being held properly in contact with the periphery of said feed-wheel by means of an adjustable pressure-wheel, Q'.

Near the opposite end of the base-board is the feed-wheel Q, and beyond the guides R is a guide, R, which also supports the record-strip, and directs it properly between the guides R R. The record-strip, as shown in Fig. 1, is oblong in cross-section, as shown also at H in Fig. 11. It is to be made of a metal which will well support itself and resist ordinary wear—such, for instance, as copper, brass, iron, or soft untempered steel. The dimensions of the strip may be varied; but in practice a strip from one-eighth to three-sixteenths of an inch wide, and from one thirty-second to one-sixteenth of an inch thick, will be found to be of convenient size for general use. It is designed to cut into the edge of this strip indentations or notches corresponding to the record-indentation of the ordinary phonograph, this indented edge to be drawn in contact with a stylus connected with a reproducing-diaphragm in the ordinary manner, and thus reproducing the recorded sounds.

The operation of the apparatus as shown in the drawings will be readily understood. The record-strip H is first passed through the guide R, and then between the guides R in contact with the stem D, and on over the feed-wheel Q and under the pressure-wheel. The strip may be delivered from a suitable reel, (not shown in the drawings,) and after leaving the feed-wheel may be wound upon another reel, or disposed of in any desired manner. The guides and guide-wheel are so arranged that the edge of the strip H will lightly touch the edge of the cutter-wheel L. Now, when the shaft N' is turned by its crank N'', motion is transmitted through the friction-wheel N, shaft M', friction-wheel M, pinion M'', and shaft P' to the cutter-wheel L, which has a knife-edge of tempered steel. The relation of the devices for transmitting motion is such that even when the shaft N' is turned relatively slowly, a very rapid rotary motion will be given to the cutter-wheel. At the same time that motion is being transmitted to the cutter-wheel from shaft N' said shaft also transmits motion through the worm o, pinion P, and shaft P' to the feed-wheel Q in the direction indicated by the arrow, and thus, while the cutter-wheel is rotating, the record-strip

H is drawn across its edge, and if, while this operation is going on, sounds are produced in front of the diaphragm C, said diaphragm will be caused to vibrate and operate the stem D to drive the record-strip against the cutter-wheel L with a range and force of movement corresponding to the air-vibrations set up by the sounds, and the cutter-wheel will consequently cut notches or indentations into the edge of the record-strip which represent an exact record of such sounds.

It will be readily seen that the cutter-wheel opposes but a slight resistance to the movement of the record-strip, as it is so sharp and its movements so rapid that the edge of the record-strip is easily and rapidly cut away when it is passed against the cutter, even though the strip be of a material of bulk which enable it to sustain a considerable handling and friction when used for reproducing sounds, by drawing its indented edge in contact with a stylus arranged to operate a diaphragm.

It will also be seen that a record of indefinite length may be produced, or short records may be produced in rapid succession, by feeding strips of the desired length to the cutter-wheel.

In order to keep the cutter-wheel clear of particles of metal which might adhere to it, a light spring, z, is arranged to bear against each side of said wheel, so as to scrape off the adhering cuttings. This is a great advantage over the old forms of phonographs, in which, as is well known, the extent of the record is limited by the dimensions of the plate or cylinder which supports the foil-strip.

The sounds reproduced by a record strip formed by my machine approach more nearly the original sounds in loudness and volume than do the sounds reproduced by the old forms of records, as by my improvement so little resistance is opposed to the movement of the strip that the diaphragm has a vibration much more nearly commensurate with the sounds projected against it than is possible when the record must be produced entirely by the force of movement of the diaphragm in driving the stylus against a record-sheet.

The record-cutter need not be limited in form to a simple rotary knife-edged disk. I have contemplated using a cutter operating after the manner of a band-saw, as shown in Fig. 4, in which the letter T indicates a steel band having one of its lateral edges beveled and sharp, and to act upon the record-strip.

I may also use a rim-wheel cutter, as shown in Fig. 5, in which the letter T indicates a spoked wheel having a rim, T', one of the lateral edges of which is beveled to a knife-edge, as shown at z.

I may also form the cutter-wheel with cutting-faces, similar to a fine file, to facilitate its cutting and smoothing of the edges of the notches; but such file-faces are not essential.

In Fig. 6 is illustrated a portion of an in-

strument between the passes, said eye, E', is constructed from a diaphragm inducing the record strip. If fixed stylus a reproducing the two giving the amplitude will be ve-

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heel cutter, as shown letter T' indicates a m, T', one of the lat- eled to a knife-edge,

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segment having two cutters, T' and T'', between the edges of which the record-strip II passes, said strip passing also through a guide-eye, E', connected to the stem D', projecting from a diaphragm, C'. In an instrument thus constructed the complete vibration of the diaphragm in both directions is utilized for producing the record, complementary portions of the record being cut in opposite edges of the strip. If such a strip be drawn between a fixed stylus and a movable stylus attached to a reproducing-diaphragm, it is obvious that the two edges of the strip will co-operate in giving the diaphragm vibrations of extensive amplitude, and thus the reproduction of sounds will be very nearly as loud as the original.

In order to give the recording-diaphragm a capacity for free and prompt vibration, I have preferred to form said diaphragm with concentric corrugations, similar to the diaphragms of pressure-gages used for indicating steam-pressure. Such a diaphragm is shown in section in Fig. 7, in which C' indicates the diaphragm, and C' C' C' the corrugations. I have found such a diaphragm very sensitive and efficient in response to sounds.

The essential principle of my improvement may be utilized for reproducing, in durable and amplified form, the fragile records made by the old styles of phonographs. In the diagram Fig. 8 is illustrated the embodiment of my improvement in an apparatus for this purpose. The letter A' designates a cylinder which may be arranged to travel longitudinally, as well as to rotate in a manner similar to that of the cylinder of the old styles of phonographs. B' is a lever provided with a stylus, U', for acting upon an old record-sheet, which may be placed upon this cylinder. Said lever has an adjustable fulcrum, f', and at the end opposite the stylus carries a pressure-roller, B'. The letter G' indicates a supporting-table, against which the roller B' will be pressed by a spring, s'. This table has an opening at g', through which plays the edge of a cutter-wheel, I', which may be given a rotary motion by any suitable means. The letter H' indicates a record-strip, which may be drawn under the wheel B' and across the edge of the cutter-wheel, and if, while the said strip is so drawn, the cylinder A' be rotated, the record-strip thereon will vibrate the lever B' and cause the roller B' to press the record-strip in contact with the edge of the cutter-wheel with a varying pressure—corresponding to the indentations of the record-sheet, which will be thus copied and given the form of a continuous strip. It is obvious that the copy may be much amplified by regulating the position of the adjustable fulcrum, so that the wheel B' will be carried by a long arm having any desired proportion to a shorter arm of the lever B', which carries the stylus.

The record-strips produced by my improved machine are peculiarly applicable for use in transmitting messages by telephone—as, for

instance, should a person desiring to transmit a telephonic message be unable to send his message immediately and have no time to wait, he may prepare a record or message strip by one of my phonographs, and the telephonic operator may use the strip in transmitting the message at a future time, or in its regular order with other messages waiting until the line can be used.

In Fig. 9 the letter U indicates a portion of a telephonic transmitter which may be used for transmitting messages either directly by the voice or through the instrumentality of a record-strip. The letter U' indicates a diaphragm arranged in the mouth-piece in the usual manner, and provided on its rear surface with a carbon button, u, which is in contact with another carbon button, u', carried by a spring, u''. The carbon button u' has projecting from its rear side a stylus, u', behind which is a guide, u', for a record-strip, h. The diaphragm U and the spring u'' are supposed to be connected with the primary circuit of an induction-coil in the usual manner. It is not necessary to explain the manner of transmitting directly by the voice; but in case a record-strip, as shown at h, is to be used, such strip is drawn through the guide u' with its indented or record edge in contact with the tip of the stylus u', and will vibrate said stylus longitudinally, so that the pressure between the buttons u and u' will be varied in correspondence with the indentations of the strip, and thus the current varied in a manner to transmit the message represented by the strip.

In Fig. 10 is illustrated another form of transmitter, in which an armature, V, is provided with a stylus, v, to receive the action of a record-strip, as shown at h', so that said armature will be vibrated in front of the core of an electro-magnet, V', and induced undulatory currents be thus set up in the coil of the magnet in correspondence with the record, such induced currents traversing a line-wire and acting upon a receiver in the usual manner.

As before stated, the record-strip may be given various forms in cross-section—such, for instance, as illustrated in Fig. 11. H indicates the flat strip, oblong in cross-section, and with rectangular edges. H' is a strip triangular in cross-section. H'' is a round strip. H''' is a flat strip having double-beveled edges, and H'''' is a strip having sharp ribs to receive the action of the cutter. These strips may be made of any of the metals hereinbefore mentioned, or any durable material which will withstand the frictional wear and handling incident to their use. It will sometimes be found of advantage to make the record-strip of soft steel and temper or harden it after the record has been cut. Such a strip will obviously be extremely durable.

Having now fully described my invention and explained the operation thereof, I wish it to be understood that I do not confine myself to the precise details of construction shown in

my drawings and heretofore particularly described, but may vary the same in any manner for the better carrying out the essential principles of my improvement.

5 What I claim is—

1. In a phonograph, the combination, with means for moving a record-strip by sound, of one or more moving cutters arranged to act upon said strip, substantially as described, and
10 for the purpose set forth.

2. In a phonograph, the combination, with the diaphragm and the moving cutter arranged to act upon a strip vibrated by said diaphragm, of feeding mechanism adapted to move a record-strip across the edge of the cutter, substantially as described.

3. In a phonograph, the combination, with the diaphragm and two moving cutters, of feeding mechanism adapted to move a continuous strip between said cutters, and intermediate devices for transmitting a vibratory motion to said strip from the diaphragm, so that

the opposite edges of said strip will be alternately pressed against the cutters, respectively.

4. A phonograph-record consisting of a metallic strip having record-indentations of varying character representing sound-waves caused by articulate speech cut through one or more of its edges, substantially as described.

5. The herein-described method of preparing phonographic records, the same consisting in vibrating a record-strip by sounds and causing said strip to be cut during and in proportion to its vibration by a cutting-instrument operated independently of the diaphragm, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHRISTOPHER COLUMBUS REYNOLDS.

Witnesses:

GEO. W. CURTIS,

WILLIAM WILKERSON.

(No Model.)

4 Sheets—Sheet 1.

E. BERLINER.
GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

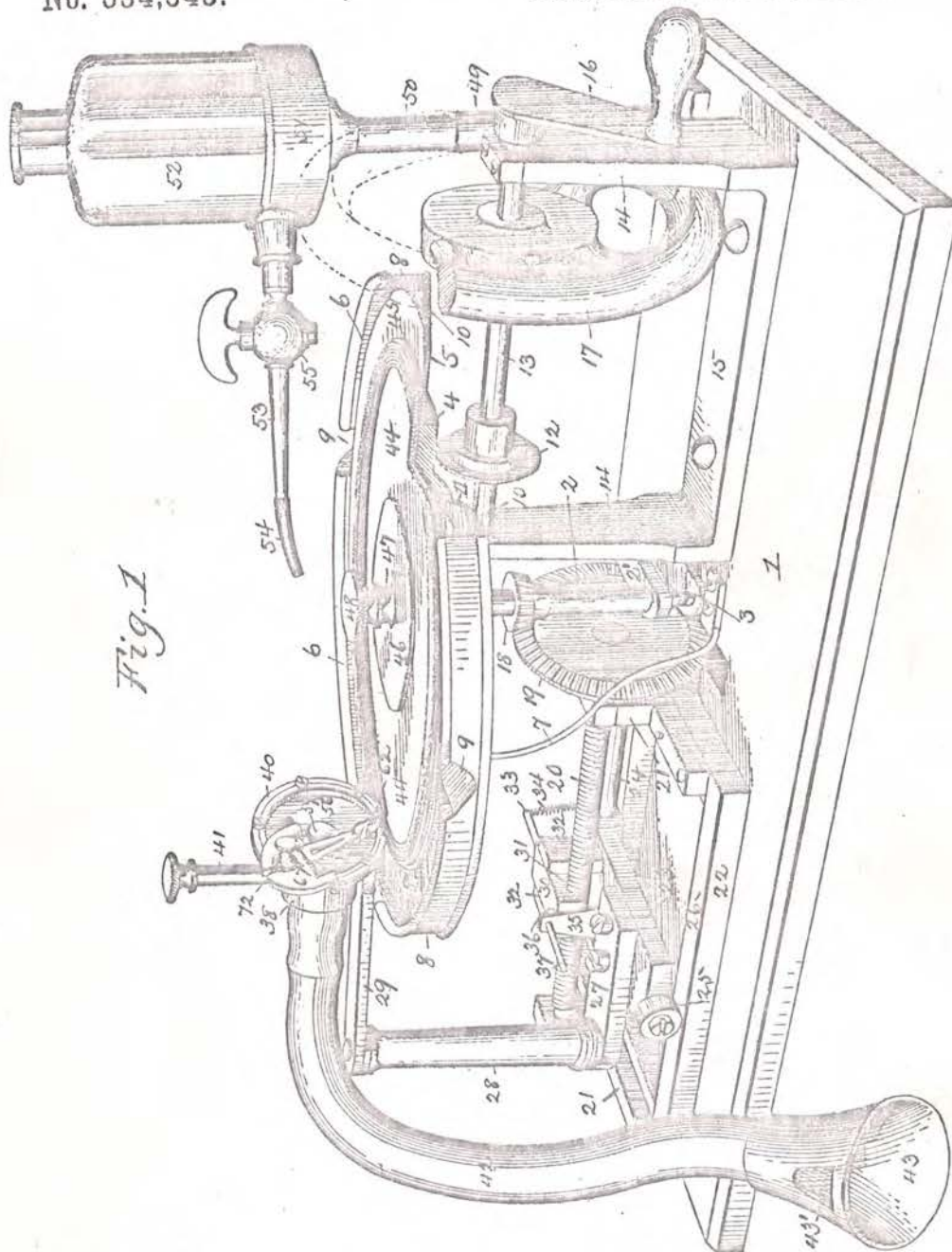


Fig. 1

Witnesses;
Rex C. Bowen.
H. T. Chapman.

Inventor:
Emile Berliner,
By Joseph L. Loomis,
Attorney.

(No Model.)

4 Sheets—Sheet 2.

E. BERLINER.
GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

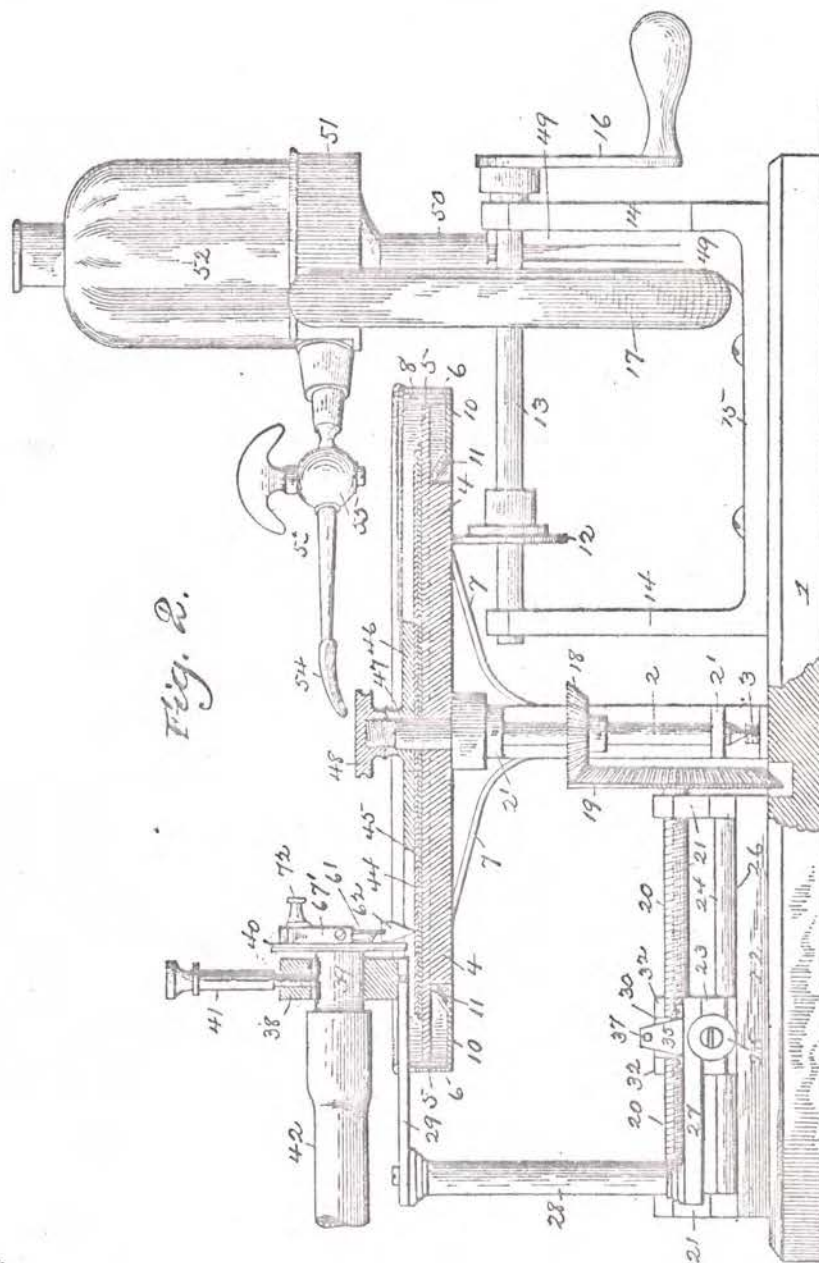


Fig. 2.

Witnesses:
J. B. McGinnis
F. J. Chapman

Inventor:
Emile Berliner
By *Joseph L. Lutz*
Attorney

(No Model.)

4 Sheets—Sheet 3.

E. BERLINER.
GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

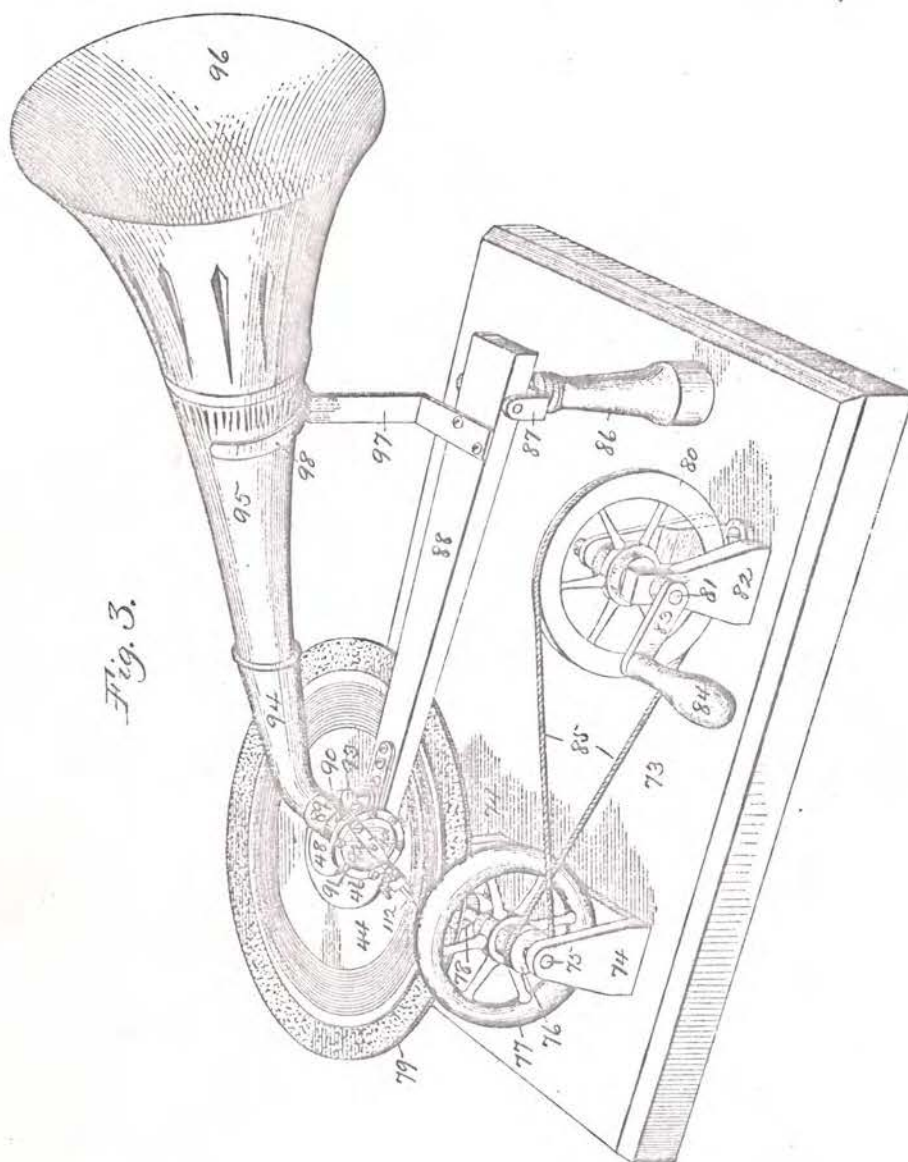


Fig. 3.

Witnesses:

Percy C. Bowen.
H. T. Chapman.

Inventor:

Emile Berliner.

By Joseph Lyons.
Attorney.

(No Model.)

4 Sheets—Sheet 4.

E. BERLINER.
GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

Fig. 4.

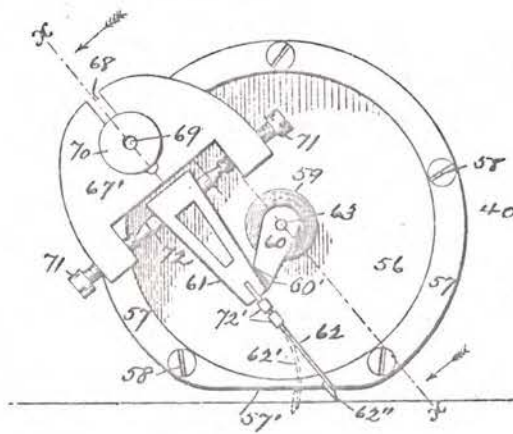


Fig. 5.

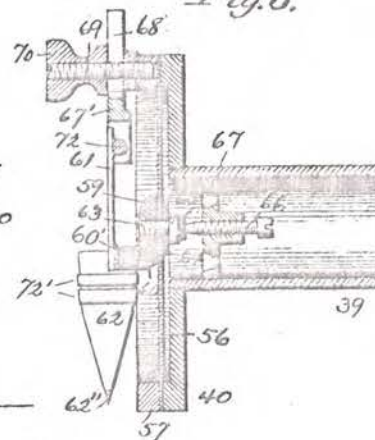


Fig. 6.

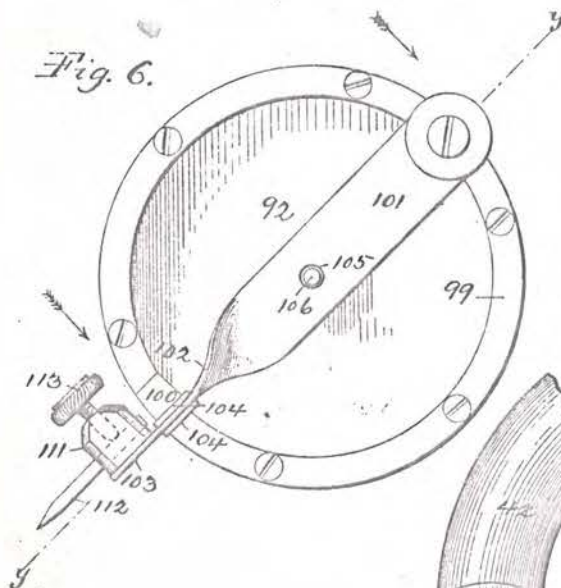


Fig. 7.

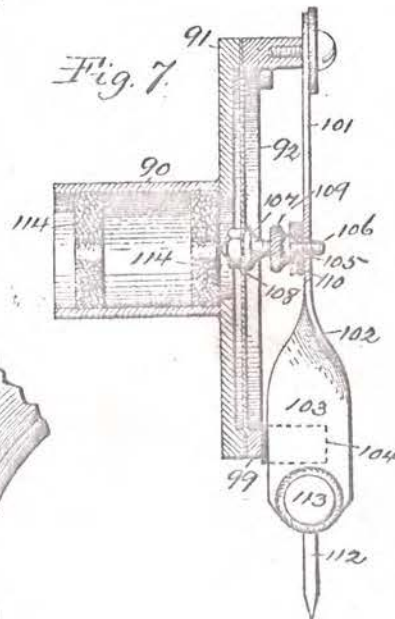
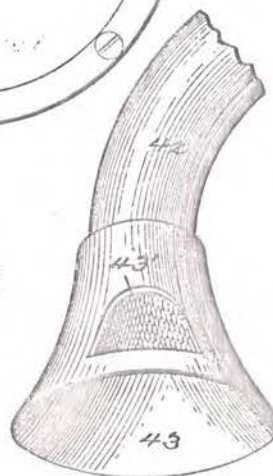


Fig. 8.



Witnesses;

Rey C. Bowen.
F. T. Chapman

Inventor;

Emile Berliner,

By Joseph L. ...
Attorney.

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR
TO THE UNITED STATES GRAMOPHONE COMPANY, OF SAME PLACE.

GRAMOPHONE.

SPECIFICATION forming part of Letters Patent No. 534,543, dated February 19, 1895.

Application filed March 30, 1893. Serial No. 427,080. (No model.)

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, and a resident of Washington, District of Columbia, have invented certain new and useful Improvements in Gramophones, of which the following is a specification.

My invention has reference to improvements in the method of and apparatus for recording and reproducing sounds, the improvements being more particularly directed to the construction of that kind of sound recording and reproducing apparatus which I have called "gramophone," and for which Letters Patent of the United States No. 382,790, dated May 15, 1888, have been granted to me.

One feature of my invention has reference to improvements in the method of recording sound by tracing upon a fatty film deposited upon a metallic surface, undulatory lines, corresponding to sound waves, and then etching such lines in the metal base, or as it is now commonly called, the record tablet; while the other features of my invention have reference to the construction of the details of both the recorder and the reproducer of the gramophone. Each of these features of improvement are designed to overcome certain difficulties, and to avoid certain imperfections heretofore met with in the operation of the gramophone. These difficulties and imperfections, and the manner in which they are avoided, will be particularly pointed out in the following detailed description with reference to the accompanying drawings, in which—

Figure 1, is a perspective view of my improved gramophone recorder. Fig. 2 is a side elevation, partly in section, of the recorder. Fig. 3 is a perspective view of a gramophone reproducer. Fig. 4, is an elevation of a recording diaphragm and stylus. Fig. 5, is a section of the same on the line $x-x$ of Fig. 4. Fig. 6, is an elevation of the gramophone reproducing diaphragm and stylus. Fig. 7, is a section of the same on line $y-y$ of Fig. 6, and Fig. 8, is a perspective view of an improved mouth-piece for the recorder.

Like numerals of reference indicate like parts throughout the drawings.

My improved gramophone recorder is shown

as a whole in Figs. 1 and 2, mounted upon a suitable base 1. About midway of the length of this base there is an upright shaft 2, journaled in brackets 2', 2', stepped at its lower end in a suitable bearing 3. This shaft carries at its upper end a circular disk 4, the outer or peripheral portion of which is reduced in thickness as shown at 5, and this reduced portion extends over a ring shaped pan 6, supported by stays or brackets 7, from which it may be lifted and removed, when required. The outer edge or wall 8, of the pan is of sufficient height to project for a distance above the disk 4, and is provided with pouring lips 9, for a purpose hereinafter described. The bottom 10 of the pan extends under the reduced portion 5, of the disk 4, and its inner edge 11, is upturned close to the under side of the reduced portion of the disk, as shown.

Bearing against the under side of the disk 4, is a friction wheel 12, secured to a horizontal shaft 13, which latter is journaled in the upper ends of posts or uprights 14 constituting the ends of a frame, the base 15, of which is secured to the base 1 of the apparatus. The position of shaft 13, and the diameter of the friction wheel 12, are such, that a portion of the weight of the disk 4, and of its shaft 2, is supported by the friction wheel; whereby the bearing 3, is relieved from a portion of that weight, and whereby frictional gearing between the disk 4 and wheel 12 is insured, without requiring special adjustment. The shaft 13, carries at its outer end a crank 16, by means of which it is rotated, and between the two uprights 14, there is secured to the shaft a heavy fly or balance wheel 17. Secured to the upright shaft 2, below the disk 4, there is a beveled pinion 18, meshing with a large bevel gear 19, on one end of a horizontal screw-threaded shaft 20, which is arranged radial to the disk 4, and journaled adjacent to the said gear 19, and also at the other end, in pillow-blocks 21, supported on the end piece of a rectangular frame 22, which in turn is fast on the base 1. Mounted upon the frame 22, so as to be movable thereon in the direction of the length of the shaft 20, there is a carriage 23, supported at one end by a guide rod 24, on which it is free to slide, and at the other end by a roller 25, movable

along the upper surface 26, of one of the side pieces of the frame 22. The carriage 23, has firmly secured to it a projecting arm 27, on the outer end of which is an upright post 28, carrying at its upper end an arm 29, parallel with the arm 27, and of such length as to overhang the disk 4, when the carriage is moved to the right, as represented in the drawings; the construction being such, that when the carriage 23 is moved in the manner to be described, the arm 29, will be carried radially over the disk 4, and any object carried thereby will participate in said movement.

The carriage 23, is moved in one direction by means of the screw-threaded shaft 20, and in order to effect this operation, there is provided a block 30, in one side of which, near one end, is formed a half nut 31, constructed to engage the threads on the shaft 20; and this block 30, is pivotally supported between ears 32, erected on the carriage 23. Projecting from the other end of the block 30, there is a pin 33, to which one end of a spring 34, is attached, the other end of said spring being secured to the carriage 23, and the tendency of the spring is to maintain the block 30, in a tilted position with the nut portion raised out of engagement with the shaft 20. In order to lock the block 30, in engagement with the shaft 20 there is provided a leaf spring 35, mounted on the carriage 20, opposite the free end of the block 30, and having on its free end a tooth 36, which passes over the top of the hinged block 30, when the nut formed in the same is in engagement with the screw threads on the shaft 20, the tendency of the leaf spring 35, being to move inwardly toward the block 30. This catch spring 35, is also provided with a pin 37, which serves as a handle for withdrawing the catch so as to unlock the block 30, and thereby allow the carriage 23 with its appurtenances to be freely moved to any position upon the frame 22.

To the free overhanging arm 29, is secured a ring sleeve 38 which receives the neck 39, projecting from one side from the frame 40, in which latter the recording diaphragm and stylus are mounted, and this neck 39, with its appurtenances is fixed in any desired position in the ring frame 38, by a clamp screw 41. The free end of the neck 39, projects beyond the ring frame 38, and receives the sound conveying tube 42, which is preferably made flexible, and which has at its free end a mouth-piece 43, the particular construction of which will hereinafter be more fully described.

The disk 4, which is in the nature of a rotary table, has hereinbefore been described and is shown in the drawings as reduced in thickness on that portion of the periphery which overlaps the inner wall of the pan 6, and if this construction is used, the disk 4, must be removable from the shaft 2. It is, however, also practicable to make the disk or revolving table, in two parts, the lower part of which extending only to within a short dis-

tance of the upper edge of the inner wall 11, of the pan, while the upper part extends over that edge to within a short distance of the outer wall of the pan. This is indicated by a dotted line in Fig. 2, and if this construction is adopted, only the upper thinner part of the table is removable from the upright shaft 2, while the lower thicker part of the table may be fixed to that shaft.

When a sound record is to be made, a record tablet of the kind described in my aforesaid Letters Patent, is placed upon the rotary table 4, and this record tablet is represented in the drawings as a circular disk 44, which has a central perforation passing over the upper end of the shaft 2. Sometimes it is convenient to interpose between the record tablet and the rotary supporting table a thin disk 45, of felt, or of some other non-resonant material. This, however, is not essential. Upon the record tablet is placed a clamping plate 46, which by preference is provided with a hub 47, which is slipped over the upper end of the shaft 2. This upper end of the shaft 2, is screw-threaded as shown, and a thumb-nut 48, is then screwed down upon the hub of the clamping plate, whereby the record tablet is securely fastened in position.

At one end of the base plate 1, there is mounted a standard 49, which may be a split tube as shown, and in which is supported by friction a stem 50, projecting from the bottom of a shelf 51, and which in turn supports a vessel 52, containing alcohol. From the bottom of this vessel extends a tube 53, preferably provided at its free end with a flexible nozzle 54; and a stop-cock 55, with which the tube is provided permits the operator to regulate the flow of alcohol from the nozzle. With my present improvement it is necessary that during the whole process of tracing the record, the record tablet be covered with a film of alcohol, and for this purpose a thin stream of alcohol is directed upon the center of the tablet, or rather upon the clamping plate 46, from which the alcohol spreads in all directions by centrifugal force, and flows over into the pan 6. When the tracing of the record has been completed, the clamping plate is removed and the record tablet also is lifted from its support by the insertion between the same of a sharp edge, such as a knife blade, or even by the finger nails of the operator; and is removed for further manipulation as described in my aforesaid Letters Patent, and also for the manipulation which will be described hereinafter.

Only a very small quantity of alcohol is used for producing a single record, but after continued use of the machine a considerable amount of alcohol accumulates in the pan, and this is removed by removing the table 4, or the upper, thinner part thereof, as the case may be, by inserting a finger in each of the pouring lips 3, and thus lifting the disk or table 4, from the shaft 2. The pan is then removed from the bracket 7, and the alcohol

is poured out and preferably back into the vessel 52, by one of the pouring lips.

The recording diaphragm 56, is mounted in the circular frame 40, between a ledge formed 5 on said frame and an annulus 57, screwed down upon the same by screws 58, as shown, or in any other suitable manner. On the rear side of that diaphragm there is applied a small block 59, of hard rubber from which 10 extends radially an arm 60, which at its free end is turned up at right angles, outwardly and into contact with the lever 61, which carries the recording stylus 62.

The block 59, is fastened to the center of the diaphragm by a screw 63, passing through 15 the diaphragm and through a washer 64, applied to the front side of the diaphragm. The head of this screw is faced with a disk 65, of soft rubber, and against the same bears the 20 point of an adjusting screw 66, which is mounted in a perforated disk or spider 67, fixed in the neck 39.

The lever 61 is mounted on a plate 67', formed with a slot 68, through which a set 25 screw 69, fixed in the annulus 57, passes. The plate 67', can thus be adjusted to various positions on the annulus, and is clamped in the adjusted position by a thumb-nut 70. One 30 end of the plate 67' is bifurcated, and screws 71, 71, passing through the legs of the fork, are formed at their ends with bearings for the pivot points of the arbor 72, which is fixed to the lever 61. This lever, is made as light as 35 practicable and as is consistent with rigidity, and the plate 67', together with the lever 61, which it carries, is so adjusted that the upturned end of the arm 60, bears upon the lever at the greatest practicable distance from the 40 axis of the spindle 72, viz: at the free end of the lever. The connection between the lever and the upturned end of the arm 60 is made by a small quantity of pitch, 60', which acts as an efficient cement, and which is applied 45 after the lever has been adjusted to its proper position. This mode of connecting the lever with the arm 60, and thereby with the diaphragm, I have found to be of great advantage for a variety of reasons, but more especially on account of the ease with which the 50 connection is made, and unmade in case of repair, and on account of the damping effect it has upon the lever.

To the end of the lever 61, is secured the recording stylus 62, by soldering or otherwise, 55 with its plane at right angles to the plane of the lever, as shown. The stylus is composed of a flat, and rather thin plate of spring steel, pointed at its free end, and provided with a tracing point 62'', of iridium. 60 The broad portion of the stylus is damped by one or two bands 72', of soft rubber, which are simply slipped over the same.

By reference to Fig. 4, it will be seen that the lever 61, with the recording stylus 62 extending across the diaphragm upon a line which 65 constitutes a chord but not a diameter of the circle of the diaphragm. They are, therefore,

eccentrically mounted with reference to the center of the diaphragm; but notwithstanding this eccentric location, the lever is rigidly 70 connected with the center of the diaphragm and thus receives the maximum amplitude of its vibration. By thus placing the lever with the stylus eccentric with reference to the center of the diaphragm both the lever and the 75 stylus may be and are made shorter than if they were located on the line of a diameter of the diaphragm. This is an important result, since the shorter the lever and stylus, the less liability there is of lost motion, and the less 80 liability there is of extra or spontaneous vibrations of the lever and stylus, and both of these facts conspire to produce an accurate tracing of the sound waves impinging against the diaphragm. 85

Where the stylus passes over the edge of casing 40, the latter, together with the annulus 57, is cut away upon a straight line, as indicated at 57'. This permits a further reduction 90 of the length of the stylus, since the record tablet may be located close to the straight edge 57'.

The body of the stylus is normally curved downwardly, as shown in dotted lines at 62', but when the diaphragm holder or frame 40, 95 is turned to cause the stylus to impinge upon the record tablet, which is the preparatory step for making a record, the stylus is unbent and becomes straight, as shown in solid lines in Fig. 4, and I have found that the best results are obtained when the stylus is at an angle of about forty-five degrees with the plane 100 of the tablet. The maximum pressure of the stylus upon the record surface is therefore equal to the force required to unbend the 105 stylus. It is very small, because the stylus is made as thin as practicable, and it is uniform for different records and for all parts of the same record.

The mouth-piece, into which vocal sounds 110 are uttered for recording, is shown at 43, in Figs. 1 and 8, and it consists of a bell shaped structure, the small end of which is secured to the sound conveying tube, while the wide, flaring end is turned toward the speaker who 115 applies his mouth to the opening. Near the edge of the mouth opening there is a perforation 43', cut into the wall of the mouth-piece, and this perforation is of such shape and size, and at such distance from the edge of the 120 mouth-piece, as to fit approximately the edge of the nose of the speaker; so that when the mouth-piece is applied, the sounds uttered by the mouth enter the wide, flaring opening, while the sounds uttered by the nose enter 125 the perforation 43'.

In making a record of vocal sounds, it is necessary that all sound waves composing the words or the song be conveyed to the diaphragm, and it has, therefore, been proposed 130 to make mouth-pieces of such size and shape as to admit within the opening both the mouth and the nose of the speaker or singer, and to fit against the face of the user around the

mouth and nose. Mouth pieces of this character are necessarily large and clumsy, and do not readily and comfortably fit different persons, while with my construction the size of the mouth-piece is reduced, and will comfortably fit different speakers.

By means of the apparatus so far described, a record of sound waves is made in the following manner: The spring catch 35, 36, is drawn back, which permits the spring 34, to lift the block 30, from the screw 20, so that the carriage 23, may be freely moved to the left, whereby the stylus 62, is carried beyond the edge of the rotary table 4. A record tablet prepared in the manner described in my aforesaid Letters Patent is then placed upon the table 4, and clamped to the same, as hereinbefore described, and the carriage 23, is moved toward the right until the point of the recording stylus is above the tablet but within the edge of the same. The casing 40, is then turned in its bearing 38, until the point of the stylus impinges upon the tablet and is unbent, as shown in Fig. 4. In this position the casing 40, is clamped by means of the screw 41. The stop-cock 55, is then opened and a thin stream of alcohol is directed upon the clamping disk 48. The wheel 17, is now rotated by means of the crank and handle 16, whereby, by means of the gearing described, the record tablet is rotated, while the stylus is carried across the face of the tablet in a radial line, removing from the tablet a fine spiral line of the fatty etching ground with which it had been covered. Sound waves are now directed against the diaphragm in any desired manner, and if vocal sounds are to be recorded, the sound conveying tube 42, with the mouth piece 43, will be used. The vibrations of the diaphragm thus produced will cause the stylus to make a tracing of an undulatory line, corresponding to the sound waves directed against the diaphragm; all as described in my aforesaid Letters Patent. During this whole time a thin stream of alcohol is delivered upon the plate 46, and the alcohol spreading out in all directions is maintained as a uniform and constantly renewed film upon the tablet. In this manner every part of the record is made under alcohol, and in this respect my present invention differs from the process set forth in my aforesaid Letters Patent.

In accordance with the said patent, alcohol is poured once for all over the tablet, and is allowed to evaporate during the process of recording. I have found that in this manner it often happens that the alcohol has entirely evaporated before the record is completed, so that a portion of the latter is made upon a dry tablet; whereby the accumulation of elementary particles of dust on the point of the stylus, which the alcohol is designed to avoid, takes place during the production of a portion of the record. With my present improvement this defect is cured, since it maintains the record tablet moist with alcohol from the beginning to the end of the operation.

After the tracing of the record has been completed, the tablet is speedily removed and before the record is fixed by etching as described in my aforesaid patent, the alcohol adhering to the record surface is quickly washed off with water. This is an important step in my improved process and greatly improves the definition of the record by etching. The reason for this is, that the alcohol slightly attacks and dissolves the fatty etching ground, so that the thin film of alcohol remaining upon the tablet, contains a slight quantity of that ground in solution. If now, the film of alcohol is allowed to evaporate an exceedingly small quantity of the dissolved ground is deposited upon the metal which has been laid bare by the stylus. This small deposit of ground sufficiently resists the action of the etching fluid to impair the definition of the final record. By simply pouring water over the record surface immediately after the tablet has been removed from the recording apparatus the film of alcohol and the ground held in solution by the same is removed, and the tracings of the stylus present a clean metallic surface, which is properly attacked by the etching fluid.

The reproducing apparatus as a whole is represented in Fig. 3.

Upon a base board 73, in standards 74, is journaled a shaft 75, upon which are mounted a driven pulley 76, a fly-wheel 77, and a friction disk 78. The latter is in frictional engagement with a rotary table 79, which is mounted upon a vertical shaft substantially in the manner described with reference to the rotary table 4, of the recording apparatus. Fig. 3, being a perspective view, the mounting of the table 79, is not visible, but is easily understood from the foregoing description. The upper surface of the table is preferably covered with a sheet of felt or other elastic and non-resonant material, as indicated by appropriate shading.

Upon the felt covered table 79, the record tablet 44, is placed and is clamped thereon substantially in the manner in which this is done in the transmitting apparatus, i. e., by means of a clamping plate 46, and a thumb-nut 48. A driving wheel 80, mounted on a shaft 81, which is journaled in standards 82, is rotated by means of a crank 83, and handle 84, and gives motion to the table 79, by means of a crossed belt or cord 85. The relation of the table 79, to the friction disk 78, is the same as the relation of the table 4, to the friction disk 12; that is to say, the table rests with the greater part of its weight upon the friction disk, so that the frictional gearing is automatically maintained. A post 86, mounted upon the base-board 73, has swiveled upon its upper end a fork 87, between the prongs of which is pivoted the swinging arm 88, which extends over the table 79, and has at its free end a clasp 89, which receives the neck 90, which projects from the center on one side of the casing 91, of the reproducing

diaphragm 92. This casing with its diaphragm, stylus and appurtenances, which will presently be described, can be thus turned in the clasp, and can be fixed in any adjusted position by a clamp screw 93.

Upon the end of the neck 90, which projects beyond the clasp 89, is slipped a flexible tube 94, which in turn receives the small end of a sound conveying trumpet 95, the flaring end 96 of which is turned toward the listener. A bracket 97, secured to the swinging arm 88, carries at its free end an elastic fork 98, which receives and supports the trumpet, and the parts are so proportioned that the free end of the swinging arm preponderates, so that the point of the reproducing stylus, which will presently be described, presses rather firmly upon the record tablet.

It will now be understood, that when a record tablet, having a record of sound waves upon its surface, produced in accordance with my invention, is mounted upon the table 79, and when the point of the stylus is adjusted in engagement with the record groove, and the wheel 80, is rotated, the rotating record groove will guide the stylus across the face of the tablet, and will at the same time vibrate the stylus and diaphragm in accordance with the undulations of the record groove. The sound waves thus produced by the diaphragm will issue from the flaring opening of the trumpet, and the sounds will be heard by a listener in front of the trumpet, or in its vicinity.

The reproducing diaphragm is mounted in the casing 91, in the usual manner, being held against a ledge by means of an annulus 99. On this annulus is formed a swelling or block 100, and diametrically opposite to the same the stylus carrying spring 101, is fastened to the annulus, and extends across the face of the diaphragm and beyond the edge of the annulus. This spring 101, is a leaf spring which faces with its flat side the face of the diaphragm up to a point, beyond the center of the latter, and is then twisted at right angles, as indicated at 102, and crosses the annulus edgewise as shown at 103. The tendency of the part 101, of the spring is to press toward the diaphragm, whereby the edge of the part 103, is made to bear with some force upon the annulus 99; and the tendency of the part 103, is to press against the swelling or block 100. The spring is therefore elastic in two directions at right angles to each other.

In order to prevent grinding of the spring against the annulus and against the block 100, a U-shaped piece 104, of soft rubber embraces the outer portion 103, where it bears upon the annulus and against the block. This soft rubber cushion also serves as a dampener for the spring. At the point where the spring passes over the center of the diaphragm, it has a perforation 105, and a screw pin 106, secured to the center of the diaphragm by two nuts 107, 108, extends loosely through the perforation. A thumb-nut 109, also placed on the screw-pin 108, and a soft rubber washer

110 between the thumb-nut and the spring serve to regulate the tension of the latter and of the diaphragm, as will be readily understood.

On the free end of the spring 101, 103, there is secured a binding post 111, in which the stylus 112, is held by the set screw 113, and may be adjusted to project to the required distance beyond the end of the spring. This stylus is preferably made of hard steel. It has a slender point, but the point should not be so sharp as to cut the bottom of the record groove which it engages.

In the operation of reproducing the sounds recorded on a tablet, the stylus is guided by the walls of the record groove, and not by the bottom of the same. Consequently it is not essential that the point of the stylus be in contact with the bottom of the groove. In fact it is preferably not in contact with the same, so that this point may be made rather dull.

The sounds emitted by the reproducing diaphragm are very powerful and ordinarily too loud to be received with comfort by a listener in front of the trumpet or other receiving tube. For this reason I have found it sometimes necessary, to reduce the volume of the emitted sound before it reaches the ear, and this I accomplish by one or more perforated and exchangeable diaphragms 114, placed in the neck 90. These diaphragms should be made of some non-resonant material like soft rubber, or cork, as indicated by appropriate shading.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. The method of recording vocal and other sounds which consists in removing from a record tablet covered with a fatty film, undulatory lines of said film by, and in accordance with the sound waves and maintaining at the same time a layer of a fluid over the film, substantially as described.

2. The method of recording vocal and other sounds upon a rotating disk covered with a fatty film which consists in spreading over said film and continuously renewing over the same a layer of a fluid and at the same time removing from said tablet undulatory lines of the fatty film by and in accordance with the sound waves, substantially as described.

3. The improvement in the art of making a gramophone record which consists in immersing and maintaining the tablet and the point of the recording stylus in alcohol during the process of recording, substantially as described.

4. The improvement in the art of making and fixing a gramophone record which consists in removing from a tablet covered with a fatty film undulatory lines of said film by and in accordance with sound waves while said film is covered with a layer of alcohol; then immediately removing the alcohol with water and then subjecting the tablet to the

action of an etching fluid, substantially as described.

5. The method of reproducing sounds from a record of the same which consists in vibrating a stylus and propelling the same along the record by and in accordance with the said record, substantially as described.

6. In a gramophone, a recording stylus pressing by its own elasticity upon the record tablet at right angles to the plane of its vibratory movements and consisting of a leaf spring terminating in a point of harder material than that of the body of the stylus, substantially as described.

7. In a gramophone, the combination of a sound receiving diaphragm and an elastic recording stylus controlled by the diaphragm and adjustable with reference to a record tablet so as to press by its own elasticity upon the same at right angles to the plane of its vibratory movements, substantially as described.

8. In a gramophone a recording stylus pressing by its own elasticity upon the record tablet at right angles to its plane of vibratory movement, and consisting of a leaf spring terminating in an iridium point, substantially as described.

9. In a gramophone, a recording stylus composed of a leaf spring terminating in a tracing point in combination with one or more elastic non-sonorous dampers, substantially as described.

10. In a gramophone a recording stylus formed of a leaf spring terminating in a tracing point in combination with one or more sleeves of soft rubber upon the leaf spring for damping the same, substantially as described.

11. In a gramophone, the combination of a sound receiving diaphragm, a lever and a recording stylus carried by the same, both extending parallel but eccentrically over the diaphragm; with a connection between the center of the diaphragm and the lever, substantially as described.

12. In a gramophone, the combination of a sound receiving diaphragm a lever and a recording stylus carried by the same, both extending over the face of the diaphragm but eccentrically thereto, with a rigid connection between the center of the diaphragm and the free end of the lever, substantially as described.

13. In a gramophone, the combination of a circular sound receiving diaphragm, a lever and an elastic recording stylus both extending parallel with the diaphragm on the line of a chord, with a rigid connection between the center of the diaphragm and the free end of the lever, substantially as described.

14. In a gramophone, the combination of a sound receiving diaphragm, a lever and an elastic stylus carried by the same, both extending parallel, but eccentrically thereto; with a bracket rigidly connected with the center of the diaphragm and removably connected to the lever, substantially as described.

ment to the lever, substantially as described.

15. In a gramophone, the combination of a sound receiving diaphragm mounted in a suitable frame, a bracket adjustably mounted on said frame, a lever pivoted in said frame extending parallel to and eccentrically with reference to the center of the diaphragm, and an elastic recording stylus carried by the lever; with a mechanical connection between the center of the diaphragm and the free end of the lever, substantially as described.

16. In a gramophone a sound receiving diaphragm and a tube for conveying sound waves thereto in combination with a recording stylus receiving motion from the diaphragm, and a screw mounted in the sound conveying tube bearing centrally upon the diaphragm for adjusting the tension of the latter, substantially as described.

17. In a gramophone, the combination of a horizontal rotary table adapted to support a record tablet, and a vertical shaft free to move longitudinally, carrying the table; with a friction disk engaged by the under side of the table for rotating the latter, substantially as described.

18. In a gramophone the combination of a horizontal rotary table mounted upon a vertical shaft and adapted to support a record tablet; with a friction disk engaging the under side of the table and partly sustaining the weight of the table, whereby the latter is automatically maintained in frictional gear with said disk, substantially as described.

19. In a gramophone, the combination of a rotary horizontal table adapted to receive and support a flat record tablet; with a reservoir of a suitable fluid, such as alcohol, discharging upon the center of the table and tablet, and an annular pan disposed underneath the table for receiving the overflow of alcohol, substantially as described.

20. In a gramophone the combination of a horizontal rotatable table adapted to receive and support a record tablet; with a reservoir of alcohol discharging upon the center of the table and tablet, an annular pan disposed under the edge of the table for receiving the overflow of alcohol, and a friction disk bearing upon the under side of the table between the center of the same and the inner wall of the pan, substantially as described.

21. In a gramophone, the combination of a horizontal rotary table adapted to receive and support a record tablet, a recording diaphragm and stylus connected by gearing with the table to move radially over and with the stylus in operative relation to the same, substantially as described.

22. In a gramophone, the combination of a horizontal rotating table adapted to receive and sustain a flat record tablet, with a carriage movable in a line parallel to a radius of the table, a recording diaphragm and stylus carried by the carriage with the stylus in operative contact with the record tablet, and

gearing connecting the table with said carriage, substantially as described.

23. In a gramophone, a sound conveying tube provided with a mouth piece having a flaring opening for the application of the mouth of the speaker and a perforation in the side wall of the mouth piece separated from and spaced with reference to the mouth opening and shaped to correspond to the shape of the nostrils of the speaker, substantially as described.

24. In a gramophone a sound reproducing diaphragm in combination with a stylus lever extending diametrically across the same, and elastic in two directions at right angles to each other, substantially as described.

25. In a gramophone, the combination of a diaphragm and a stylus carrier composed of a leaf spring twisted at one point so as to bring the edge of one portion at right angles to the face of the other portion, whereby it is elastic in two directions, substantially as described.

26. In a gramophone the combination of a reproducing diaphragm and stylus; with a stylus carrier composed of a leaf spring extending flat-wise over the face of the diaphragm and edgewise over the edge of the diaphragm, substantially as described.

27. In a gramophone the combination of a reproducing diaphragm mounted in a suitable frame the latter being provided at one point with a boss or stop; with a double elastic stylus carrier composed of a twisted leaf-spring tending toward the diaphragm and against the boss or stop, substantially as described.

28. In a gramophone, a reproducing diaphragm and stylus in combination with an elastic stylus carrier extending over the face of the diaphragm and tending toward the same, of an adjustable connection between the diaphragm and stylus carrier and adjustable for varying the pressure between diaphragm and style carrier, substantially as described.

29. In a gramophone the combination of a reproducing diaphragm mounted in a suitable frame provided with a boss or stop; with a

double elastic stylus carrier tending toward the diaphragm and toward the stop, and elastic non-resonant dampers interposed between the style carrier and the diaphragm and between the style carrier and the frame and stop, substantially as described.

30. In a gramophone a sound reproducing diaphragm and a sound conveying tube for the same, with one or more non-resonant perforated diaphragms in the said tube for reducing the volume of sound conveyed to the ear substantially as described.

31. In a gramophone a recording stylus pivoted to move in response to the vibrations of a diaphragm and elastic in a plane at right angles to such motions, substantially as described.

32. In a gramophone, a reproducing stylus having a wedge-shaped point engaging the walls of the record groove, substantially as described.

33. In a gramophone reproducer, a stylus carried or formed by a spring fixed at one end to the diaphragm holder and freely extending across and beyond the same and operatively connected with the center of the diaphragm, substantially as described.

34. In a gramophone reproducer, a spring constituting or carrying a stylus, fixed at one end to the diaphragm holder and extending across and beyond the periphery of the same and freely pressing against the diaphragm, substantially as described.

35. In a sound reproducing apparatus consisting of a traveling tablet having a sound record formed thereon and a reproducing stylus shaped for engagement with said record and free to be vibrated and propelled by the same, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMILE BERLINER.

Witnesses:

HENRY E. COOPER,
F. T. CHAPMAN.

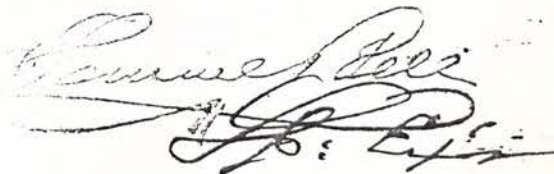
U. S. C. C. E. D. of Pa.

American Graphophone Co. vs. Berliner Gramophone Co. et als.

U.S. Patent

Defendants' Exhibit No. 10, 548,623, Oct. 29, 1895,

Berliner, Gramophone.

A handwritten signature in dark ink, appearing to read "Samuel J. Davis". The signature is written in a cursive style with a large, looping initial 'S'.

(No. Model.)

E. BERLINER.

SOUND RECORD AND METHOD OF MAKING SAME.

No. 548,623.

Patented Oct. 29, 1895.

Fig. 1.

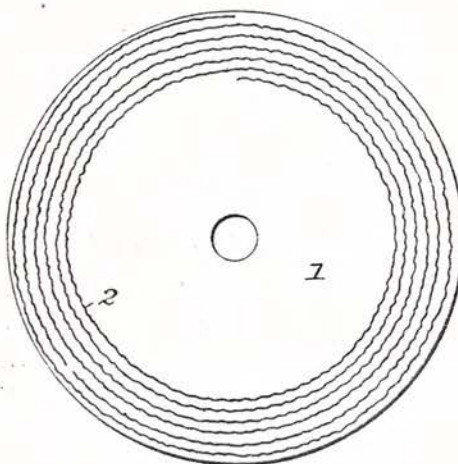
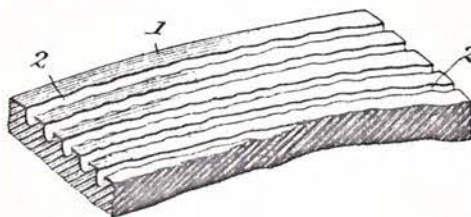


Fig. 2.



Witnesses
John Hinkel
P. J. Chapman

Inventor,
Emile Berliner,
By *Joseph Long*
Attorney

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA.

SOUND-RECORD AND METHOD OF MAKING SAME.

SPECIFICATION forming part of Letters Patent No. 548,623, dated October 29, 1895.

Application filed March 18, 1893. Serial No. 466,708. (No model.)

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Processes of Making Copies of Sound-Records; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in sound-records and in the method of making the same.

The present invention relates more particularly to the production of copies or duplicates of the flat sound-records as made by gramophone in the manner set forth in Letters Patent granted to me on November 8, 1887, No. 372,786, and on May 15, 1888, No. 382,790.

The sound-records, as is well-known, consists of regulatory grooves of even depth, as distinguished from non-undulatory grooves of varying depth produced by other methods of recording sounds.

The sound-records of the gramophone are generally zinc disks into which a spiral record of sound-waves is etched. Other substances than zinc capable of being etched into may of course be used.

The simplest way for making a duplicate copy of such a record is to impress it in wax, deposit copper thereon, and detach the copper shell. This is the well-known method used by electrotypers. There is, however, a loss in the perfection of the surface, resulting from the fact that electrotypers' wax is porous and uneven of surface, and the resultant copper copy containing the sound-record is not as good in tone quality as the original. It is therefore necessary to deposit a copper or other metallic matrix directly on the original zinc record. This I do by first thinly covering the zinc with a material capable of resisting the action of the sulphate of copper solution usually employed for electroplating or typing, and then deposit copper over that, and when thick enough detach the copper deposit.

My method is to cast the previously-cleaned zinc-record disk in a cyanide-of-copper or cyanide-of-brass solution, electrolytically, by

which a very thin film of copper or brass adheres to the zinc. After being thus prepared, the coated zinc disk is placed into a sulphate-of-copper bath and copper deposited on it electrolytically. The deposit when thick enough is then detached and forms an accurate matrix, showing the sound-record of the zinc disk in reverse. This matrix can then be impressed into suitable material and thereby produce exact duplicates of the original record-sheet.

I have found hard rubber and celluloid to be excellent materials from which to make such duplicates. These substances when heated become very soft, and when in this soft state they are impressed with a matrix, such as above described, and are cooled while still under pressure, and the resultant rubber or celluloid sheet retains all the characters of the matrix, and thus forms a copy record of the original zinc disk. In impressing a copper matrix on softened rubber, however, the sulphur fumes which are generated when heating the rubber attack the copper and destroy the smoothness of its surface. I have therefore found it necessary to coat the copper matrix with a substance capable of withstanding the sulphur fumes, and I find electrolytically-deposited iron or nickel a proper substance to accomplish the desired effect. The copper matrix is therefore cleaned and placed in a nickel or iron bath, and a thin coating of iron or nickel is deposited on it by an electric current. The matrix thereby becomes protected against sulphur fumes, and iron and nickel being harder than copper the matrix, by being thus coated, becomes more durable, and withstands pressure for a longer period. It is also possible with such a matrix to press unvulcanized rubber into it, vulcanize the rubber while attached to the matrix, and then detach it, when a true copy of the original sound-disk will be the result.

In the annexed drawings, forming part of this specification, there is shown in Figure 1 a plan view of a sound-record made in accordance with the present invention, with the lines representing the record greatly exaggerated; and Fig. 2 is a perspective view of a small portion of a sound-record copy on an enlarged scale.

Referring to the drawings, there is shown a

disk 1, of hard rubber or like material, having in its face an undulatory spiral groove 2 of even depth representing sound-waves.

What I claim is—

5 1. The process of duplicating flat sound records, which consists in depositing copper or other like metal on an original record, then detaching the copper reverse thus produced and facing the same with a layer of hard
10 metal which is not attacked by sulphur, and then pressing the reverse into temporarily softened hard rubber, substantially as described.

15 2. The process of duplicating flat sound records, which consists in facing an electro-deposited reverse of a record, with nickel or iron, and then pressing this reverse into hard rubber, substantially as described.

3. As an article of manufacture, a sheet of hard rubber having upon its face an undulatory groove of even depth representing sound waves, substantially as described.

4. As an article of manufacture, a sheet of hard rubber having pressed into its face an undulatory line of even depth representing
25 sound waves, substantially as described.

5. A copy of a flat sound record, which consists of a disk of hard rubber having impressed upon its face the lines representing the record, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

EMILE BERLINER.

Witnesses:

S. E. YOUNG,

GEORGE SEIDENSPIMER.

It is hereby certified that in Letters Patent No. 548,623, granted October 29, 1895, upon the application of Emile Berliner, of Washington, District of Columbia, for an improvement in "Sound-Records and Methods of Making Same," an error appears in the printed specification requiring correction, viz: In line 50, page 1, the word "cast" should read *coat*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

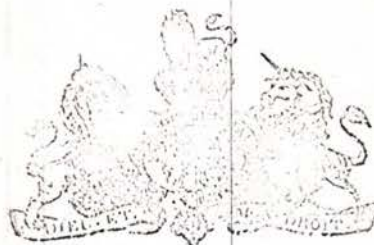
Signed, countersigned, and sealed this 26th day of November, A. D. 1895.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:

JOHN S. SEYMOUR,
Commissioner of Patents.



A.D. 1878, 24th April. N° 1644.

SPECIFICATION

OF

THOMAS ALVA EDISON.

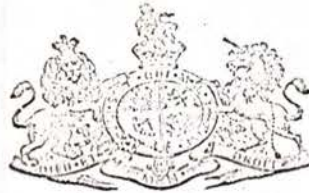
RECORDING AND REPRODUCING SOUNDS.

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A.D. 1878, 24th APRIL. N° 1644.

Recording and Reproducing Sounds.

LETTERS PATENT to Thomas Alva Edison, of Menlo Park, in the State of New Jersey, United States of America, for the Invention of "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

Scaled the 6th August 1878, and dated the 24th April 1878.

PROVISIONAL SPECIFICATION left by the said Thomas Alva Edison at the Office of the Commissioners of Patents on the 24th April 1878.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN
5 REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

My present improvements are for more fully developing and perfecting the device heretofore invented by me, and known as the "phonograph."

By extensive experiment and research I have been enabled to obtain very perfect articulation and to produce a record in a convenient form for preservation.

10 The sound vibrations are made to move a point that by preference is a diamond or other very hard substance and of a peculiar shape. The sound vibrations in the atmosphere act upon a diaphragm or other body capable of motion, and the same moves the indenting point, and acts as a phonograph. The indented material is properly designated a phonogram, and it is preferably metallic. Sometimes tin-
15 foil is used upon a grooved surface; sometimes a thin sheet or leaf of metal is placed upon a piece of paper having a surface of parafin or similar material.

Sometimes the metallic surface is copper, and where a matrix has been made of steel or iron by electrotypes deposit, or otherwise, upon the phonogram it may be hardened and used for impressing a sheet or roller of metal, and thereby the original
20 phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence, or words, or sounds phonetically.

[Price 10d.]

Edison's Improvements in Recording and Reproducing Sounds.

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "phonet."

In order to facilitate production, use, and preservation of the phonograms I employ a ring or margin of thick paper or pasteboard, caused to adhere to the foil or sheet by resinous substance; this is used as a gauge in placing the sheet in the instrument or replacing the same in the phonet. I find that a disc revolved by gearing, and a weight or spring, and the movement regulated by a fan or governor, is a convenient device for presenting the surface to be indented to the phonograph, and the phonograph is on an arm that swings towards and from the centre of the disc, and is guided by grooves or other convenient mechanism.

The phonet device takes the place of the phonograph device when the sounds are to be reproduced.

When the sheet of material is wrapped around a cylinder its edges are passed down into a slit and held firmly. Either the cylinder may be moved endwise by a screw, or the phonograph or phonet devices be moved along the cylinder, and where the same sound is to be reproduced periodically, as calling out the hours of the day in a clock, or reproducing the sounds of animals in toys, the phonet is to be brought to the place of beginning automatically.

The phonographic devices employed by me are preferably a diaphragm of metal, against which the sound vibrations act. Sections of rubber tube applied to the surface act as dampers to prevent false vibrations; pieces of felt or similar yielding material may be used for the same purpose, and a small delicate hoop of spring metal between the diaphragm and the indenting point renders the phonogram more perfect than it would be if the diaphragm acted upon the point direct. A similar effect is produced by a disc upon the arm that carries the point, said disc being so close to the diaphragm that the atmosphere will produce the vibrations.

It is often advantageous to use a case between the mouth of the speaker and the diaphragm to gather or hold the sound, and in some instances the head of the speaker should be inserted into this case, up through a hole in the bottom. The mouth-piece is sometimes slotted or perforated, and has irregular edges to re-inforce the living sounds, and sometimes a membrane of rubber or gutta percha is fitted to the teeth, and forms a bag between the lips and the diaphragm.

The disc upon the arm that carries the point as aforesaid may be acted upon by a magnet, and the current through a helix from a diaphragm, or the motion of the arm and points may serve to set up a secondary current through such helix in consequence of the motion given by the phonogram to the point. The arm carrying the point in this latter case should be magnetised.

The phonogram may be produced by the direct action of air concentrated to the spot by a funnel terminating with a small hole, the end of the funnel being almost in contact with the moving surface to be indented.

When the foil is perforated instead of indented it can be rolled up in the form of a horn or cylinder, and revolved, and the articulation result from air blown from the end of a small tube passing through the perforations as they are presented in succession.

Leverage is sometimes employed between the diaphragm and the phonogram, either to lessen or increase the motion of the phonographic action in recording, or of the phonetic action in speaking, and for recording quartette, trio, and other characters of singing, two, three, four, or more phonographic devices are employed upon one cylinder or plate, and the sounds will be reproduced by corresponding phonets; or where singing is conveyed through tubes to one diaphragm the phonographic record will be the combined tones, and the reproduction by the phonet will be complete and correct.

I find that an arm at right angles to a diaphragm, with a point resting upon the phonogram, will reproduce the tones by the weight and leverage of the arm moving the diaphragm.

The phonogram may be in the form of a disc, a sheet, an endless belt, a cylinder, a roller, or a belt, or strip, and the marks are to be either in straight lines, spiral,

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- zig-zag, or in any other convenient form, so long as the apparatus is adapted to bringing the same into contact with the phonet or speaking part of the apparatus, and the reproduction of the phonogram from a matrix or copy in relief of an original phonogram may be made upon a belt, roller, cylinder, plate, or other convenient surface.
- For amusement and instruction this phonograph is capable of extended use. For instance, a revolving cylinder containing phonograms of the letters of the alphabet and phonet keys, with corresponding letters on them, can be used in teaching the alphabet; and phonogram sentences, speeches, and other matters can be spoken by the phonet and repeated by the learner without the eyesight being called into use.
- For amusement or instruction the phonogram can be of a dog's bark, a rooster's crow, a bird's song, a horse's neigh, a lion's roar, and the like, and the phonogram can be used in a toy animal with a single phonet for the reproduction of the original sound.
- This phonograph or speaking machine applied to a mask produces a semblance of vitality if the phonogram is made to operate upon moveable lips by levers, and in the production of such a phonogram a portion of the surface is to be indented by delicate levers and points, receiving motion from the lips during articulation; thereby a correct reproduction of the motion of the lips is obtained.
- In connection with the phonet it is important to avoid the sound that usually results from the rubbing action of the phonogram upon the point. I am enabled to prevent this by an electric action between the point and the phonogram. In this case the phonogram should be of iron, and the point of steel and the parts magnetised so as to slightly repel each other; the point will follow the undulations and reproduce the sounds by the phonet.
- It is important that the point used in the phonet correspond in shape to that of the phonograph, but slightly smaller, so as to follow the bottom of the depressions without contact upon the sides.
- The diaphragm or other body employed in the phonet to receive motion from the phonogram is connected with a funnel of paper or other resonant substance that acts as a sounding board to render the phonet louder and more distinct.

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SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said Thomas Alva Edison in the Great Seal Patent Office on the 22nd October 1878.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

This Invention consists in means for recording in permanent characters the sounds made by the human voice in speaking and singing, those made by musical instruments, birds, animals, or any sound whatever, and in means for reproducing those sounds at any desired time.

The sound vibrations act upon a diaphragm or other body capable of motion; this diaphragm is at the back of a chamber provided with an opening or mouth-piece, and to this diaphragm an indenting point is secured. This instrument I term a "phonograph." The phonograph is adjusted to position with its indenting point contiguous to a moving surface covered with a thin sheet of metal foil or other suitable material, or else the surface with the metal foil is stationary, and the phonograph movable.

The surface upon which the metal foil is secured is by preference grooved spirally, and this indenting point indents the foil in the line of this groove as the diaphragm is moved back and forth by the sound vibrations; these indentations are a record of the sound waves, and form the characters for reproducing the sounds. This indented sheet I term a "phonogram."

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "phonet." It is similar in construction to the phonograph, being provided with a diaphragm and point, but the mouth-piece is by preference funnel-shaped to render the sound loud and distinct. The sounds are reproduced by the phonet being adjusted to place so that the point of its diaphragm is at the beginning of the spiral line of indentations, and as the surface containing the indented foil is moved the diaphragm of the phonet is vibrated by the point passing from one indentation to the next, hence the diaphragm receives the same movement from the indentations as when making those indentations, consequently the sounds made by the phonet will be the same as those that operated upon the diaphragm of the phonograph.

In the Drawing Fig. 1 is a section of the phonograph and sectional elevation of the mechanism for presenting the surface to be indented; and Fig. 2 is a plan of the same.

The phonograph is made of the body portion *a*, diaphragm *b*, and indenting point *c*. The body portion *a* has a central opening forming the mouth-piece into which the person speaks, or through which opening the sound vibrations pass to act upon the diaphragm, and the diaphragm is secured at its edges to the body *a*, leaving a space between the body and diaphragm in order that the diaphragm may vibrate freely. The indenting point should be a diamond or other very hard substance.

The diaphragm is made of a thin sheet of iron or other material and it is preferable to place the indenting point upon a delicate spring arm *e*², and to employ a short piece of rubber tubing *e*³ between the spring and diaphragm: this rubber acts as a damper to prevent false vibrations of the diaphragm.

The phonograph is upon a lever arm *i* pivoted at *5* to the vertical stud *6*, so that the phonograph may be raised or lowered vertically, or moved horizontally for a purpose hereafter explained.

It is now to be understood that if a person speaks with his mouth near the mouth-piece of the phonograph the sound vibrations will act upon the diaphragm, and vibrate it, and communicate to the indenting point a similar movement, and that if a piece of metal foil or other material susceptible of being indented is placed

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beneath or behind the indenting point and caused to move regularly, or the indenting point moved over the material; that said material will be indented and form a perfect record of the sound vibrations.

I will now describe the means for sustaining the sheet to be indented, and the mechanism for moving the same:—*d* is a disk or plate secured to and turning with the shaft *e*, and hinged to this disk is a ring frame *f*; this disk *d* has two spiral grooves 3, 4, in its surface. There are pins 2, 2, upon the surface of the disk, and holes at corresponding places in the ring frame; the sheet to be indented is of a size and shape to correspond with that of the disk *d* and frame *f*, and said sheet has holes in it corresponding to the position of the pins 2, 2, and these holes form register marks in placing or replacing the sheet upon the disk *d*, and after the sheet is so placed the ring frame *f* is brought down upon the sheet and holds it firmly in place. There may be a central opening in the indented sheet of a size slightly larger than the space occupied by the spiral 3, and the outer edges of the sheet are stiffened by a ring of thick paper or pasteboard caused to adhere by glue or other adhesive material. The surface of the disk *d* is made with two spiral grooves 3 and 4 as aforesaid; the groove 3 is a guide for a pin that is upon an arm *g* on the phonograph, and the groove 4 is for the indenting point *c*. As the disk and sheet are revolved the groove 3 causes the indenting point to occupy a position immediately over the line of the spiral 4, and the indentations will be made upon the sheet of foil in a line corresponding to that of the spiral 4, shown in Fig. 2. The indentations made in the foil are a complete record of the sound vibrations that acted upon the diaphragm *b*, and from this indented sheet, which I term a "phonogram," the sounds are reproduced. The phonograph is carried outwardly by the spiral 3, and in so doing the parts swing upon the vertical stud 6. By depressing the outer end of the lever *i* the phonograph is raised so that it can be swung aside from the disk *d* to allow of the ring frame *f* being thrown back and the indented sheet or "phonogram" removed from the disk.

The shaft *e* is revolved by a weight, or spring, and gearing at *h*, and the spring is wound up by moving the lever *k* back and forth, which acts upon a ratchet and pawl of ordinary construction; *l* is a lever provided at its outer end with an inclined groove, in which is a pin on the lever *m*, and the other end of this lever *m* is connected with the coupler *m'* by moving the lever *l* one way or the other, the shaft *e* will be connected to or disconnected from the gearing *h*, and hence the disk *d* stopped or started at pleasure without interfering with the motor.

As it is necessary that the shaft *e* should be revolved with uniformity I provide a governor at *n* to prevent the apparatus revolving too rapidly; and this may be made as in Figs. 1, 3, & 4, in which there are metal blocks *o* at the ends of spring arms from a cross head on a shaft that is driven by the gearing *h*, said blocks swinging radially and acting against the interior of a stationary cylinder *p* if the speed becomes too great, thereby checking the speed by the friction of the blocks against the cylinder. These spring arms may be secured at one end to a prismatic block as shown in Fig. 5. It is preferable to cover the surface of the blocks *o* next the cylinder *p* with felt or similar material that will slide upon the interior surface of the cylinder *p*, but produce more or less friction, according to the centrifugal action.

The guide spiral 3 may be dispensed with, and either of the devices shown in Figs. 6, 7, 8, or 9, made use of.

In Figs. 6 and 7 the shaft *e* projects above the surface of the disk *d*, and there is a tooth upon the shaft contiguous to a rack bar extending from the phonograph, hence each revolution of the shaft, the rack bar, and phonograph will be moved the space of one tooth, consequently the lines of indentations will be parallel and concentric to the shaft *e*, excepting at the places when the tooth acts to move the rack bar and phonograph outward or inward. In this case the spiral grooves are cut to correspond to the feed.

In Fig. 8 a worm upon the shaft *e* acts upon a worm pinion to revolve the shaft *e'*, and the worm at the other end of this shaft *e'* acts upon teeth around the base of

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the lever *i* on the stud 6. By this device the phonograph will be moved outward gradually, and the line of indentations will be in a spiral corresponding to the continuous spiral groove in the plate *d*.

In Fig. 9 the shaft *c* is made with a fusee at *p*¹, and one end of a swinging arm connected to the phonograph takes against the same. The spirals of the fusee gradually move outward the phonograph, as the disk and shaft are revolved, and the line of indentations will be spirally the same as that made by the spiral 3.

In Fig. 10 the shaft *c* is provided with a screw pinion meshing with teeth upon a cam wheel 7. This gives the same movement to the phonograph as the spiral groove 3.

In Fig. 11 the guide-groove 3 for the arm and pin *g* is upon a disk *d*¹ upon the shaft *c*, but the groove 3 occupies the same relative position upon the disk *d*¹ as the groove 4 upon the disk *d*, so that the phonograph is moved outwardly by the groove of the disk *d*¹, swinging both the arms *g* and *i* upon the vertical pivot 6.

Instead of the sheet of metal foil being upon the disk *d* it may be wrapped upon a cylinder *q*, as in Fig. 12. In this case the cylinder is upon a shaft *e*¹ revolved by the gearing at *h*¹, and upon said shaft there is a right and left hand screw at *k*¹, and there is a corresponding double spiral groove in the surface of the cylinder *q*. The phonograph is secured to a sliding shaft *l*¹, and said shaft is moved endwise back and forth by the screw *k*¹ acting upon an arm *m*² that is secured to the said shaft *l*¹. As the phonograph is moved in one direction the line of indentations is made spirally in the foil on the cylinder *q*, and when the arm *m*² reaches the end of the screw it will be moved in the other direction by the reverse screw thread, and the phonograph will make a second spiral line of indentations that will cross the first spiral line. This feature is especially available for a phonet where the surface of the cylinder *q* is formed of an electrotypo or other copy of the phonogram, so that the words or sounds may be reproduced automatically and at intervals if desired.

It is preferable to make use of a thin metal plate *n*², see Figs. 13 and 14, pivoted at one end and fitting within a longitudinal groove in the surface of the cylinder *q* for securing the edges of the metal foil and holding it securely upon said cylinder. The top of this plate *n*² is flush with the surface of the cylinder, and grooved to correspond with the grooves in the cylinder, so as not to interfere with the indenting point. A wire may replace this device, such wire being secured by arms at each end of the cylinder, and raised and lowered in and out of the groove by a cam or otherwise. I find that an interruption of one-eighth of an inch space where there is no recording is not detected by the ear.

The apparatus shown in Figs. 13 and 14 is similar to that shown in Fig. 12, except that the phonograph is stationary and the cylinder moves horizontally, and the shaft *e*¹ is only provided with a screw thread in one direction, hence the cylinder will have to be moved back by hand to bring it to place if desired to reproduce the sounds from the phonogram, or to position the phonograph if a new sheet of foil is to be indented after the first one has been removed. This is readily accomplished by raising the arm *o*¹ and its tooth from the screw *k*¹, which leaves the shaft *e*¹ and cylinder free to be moved back and forth.

In Fig. 15 the phonograph is fitted to move horizontally instead of the cylinder *q*, as in Fig. 12, but the shaft *e*¹ is provided with a screw thread in one direction only, hence the phonograph has to be positioned by hand after the arm *o*¹ has been raised from the screw *k*¹.

In Figs. 12 and 15 the phonograph can swing upon the shaft *l*¹ to raise the indenting point from the cylinder *q*, and allow for the removal or insertion of a sheet of foil, and there is a stop at 8 for adjusting the position of the phonograph when brought down to indent the foil.

In Figs. 13 and 14 the phonograph is upon an arm pivoted at 9, so that it can be swung horizontally away from the cylinder *q* for the purpose aforesaid, and the adjustable stop 8 is also provided.

Thus far I have described the "phonograph" or instrument upon which the

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sound vibrations act, and which instrument acts to indent the sheet of foil and produce the "phonogram" or record of such sound vibrations.

Mechanism has also been described for presenting the sheet of foil to be indented by the phonograph.

5 I will now describe how the sounds are reproduced from the phonogram.

If it is desired to reproduce the sounds from the phonogram in the same instrument in which the phonogram was produced it is only necessary that the indenting point *c* be made to traverse the line of indentations in the phonogram, and that a funnel-shaped mouth-piece, shown by dotted lines in Fig. 1, be added to the phonograph to aid in increasing the loudness and distinctness of the sound. The instrument in this form I term a "phonet."

10 In the instrument shown in Figs. 1, 2, 6, 7, 8, 9, 10, 11, 13, 14, and 15, the phonet requires to be positioned by hand, as before explained, in order that the point *c* may be placed at the beginning of the spiral line of indentations. As the point *c* passes from one indentation to the next, either by the foil being moved beneath said point, as in Figs. 1, 2, 6, 7, 8, 9, 10, 11, 13, and 14, or by the point moving over the foil, as in Figs. 12 and 15, the diaphragm *b* receives a movement corresponding to the depth of the indentations, and corresponding also with the same movement it received from the sound vibrations when making those indentations, hence air waves will be produced by the movement of the diaphragm that will make sounds by passing through the mouth-piece of the phonet that will be exactly the same as the sounds that acted upon the diaphragm of the phonograph.

The material upon which the record is made may be of metal foil, such as tin, iron, copper, lead, zinc, cadmium, or a foil made of composition of metals.

25 Paper or other materials may be used, the same being coated with paraffine or other hydrocarbons, waxes, gums, or lacs, and the sheet so prepared may itself be indented, or the material, say paper, may be made to pass through a bath of hot paraffine and thence between scrapers. Thin metal foil is now placed on the material, and the sheet passed through rollers, which give it a beautiful smooth surface. The indentation can now be made in the foil, and the paraffine or similar material, and the indenting point, does not become clogged with the paraffine in consequence of the intervening foil.

If the copper foil, or tin foil with copper surface is used, and a matrix of iron or steel made by electrotype deposit or otherwise upon the phonogram, such matrix may be hardened and used for impressing a sheet or roller of metal as hereafter mentioned; thereby the original phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence or words or sounds phonetically.

40 I will now briefly describe some modifications in the construction and operation of the phonograph and phonet.

In Fig. 16 the indenting point *c* is upon a spring arm *c'*, as in Figs. 1 and 2, but there are short sections of rubber tube *c''* at each side of the diaphragm *b* to dampen the diaphragm and prevent false vibrations.

45 In Fig. 17, the rubber of the diaphragm acts against the outer end of the arm *c'* to increase the leverage and lessen the depth of indentations in the foil and allow of the record being made in less yielding material than tin foil.

Fig. 18 shows a modification of the last-mentioned device, the pressure being applied to the arm *c'* between the indenting point and the support for the arm so as to increase the depth of the indentations.

Fig. 19 shows the arm *c'* made as a lever with a spring.

Fig. 20 shows the indenting point upon the center of a spring bar that is firmly held at each end; the bar is connected at its center to the diaphragm *b* by a string or otherwise.

Fig. 21 represents the diaphragm *b* as of concave form instead of flat.

Fig. 22 shows the indenting point upon a spring secured to the diaphragm.

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Fig. 23 shows a disk upon the spring e^2 of the indenting point; this disk is placed quite close to the diaphragm and is moved by the air as the diaphragm is vibrated, the disk being so close to the diaphragm that the two will vibrate together, as air cannot pass between or escape as rapidly as the vibrations take place.

Fig. 24 shows the diaphragm vibrated by electro-magnetism; in this case the diaphragm is to be of iron, and the power of the electro-magnet will be varied by a rise and fall of electric current passing through the helix of the electro-magnet; this rise and fall of electric tension is to be produced by the action of sound upon a diaphragm and connections in an electric circuit.

Fig. 25 shows the method of vibrating the indenting spring and point by the direct action of an electro-magnet without the use of a diaphragm, the electric tension in the helix being varied by sound vibrations upon a diaphragm.

Fig. 26 shows the spring arm e^2 connected to one end of a permanent magnet so as to highly magnetize the reproducing point; the foil should be of iron. When the point passes an indentation there will be less attraction than when passing no indentation; this will give good articulation free from the scraping noise of the point on the foil, for in this case it does not touch the foil, but is worked by magnetic attraction.

Fig. 27 represents two instruments in connection with the cylinder g ; in this case the phonet and the phonograph are separate. The phonograph records in the usual manner, but the phonet has its diaphragm set in motion by the rise and fall of the lever e^2 . This reduces the scraping noise of the foil and acts by leverage, and a slight tension to move the diaphragm as the phonogram is moved beneath the point c .

Fig. 28 shows an arrangement whereby four persons may speak simultaneously and have records made in separate parallel lines upon one cylinder, and the phonogram will reproduce the sounds the same as though it contained the record of but one voice.

Fig. 29 shows a single phonograph adapted to receive the voices of three persons as in singing; the sounds made by the three voices are conveyed through flexible or other tubes to the diaphragm, and will be recorded in a single line of indentations, but when reproduced by the phonet the sounds uttered will correspond to the three voices.

In Fig. 30, the foil is sustained upon a hollow cylinder with a funnel-shaped end. The record is made upon the foil in the usual manner by the phonograph, excepting that holes are made entirely through the foil. A nozzle with a small opening is placed so that it will always be opposite the line of perforations as the cylinder is revolved. This nozzle is connected to a source of compressed air or other fluid, and every time a perforation comes opposite the nozzle, a puff of air passes into the cylinder and a sound is produced upon the principle of the siren. The nozzle may be placed on a spring to keep the end of the nozzle in contact with the line of perforations.

Fig. 31 shows the phonograph as made with a large chamber between the diaphragm and the mouth-piece; this is especially useful in collecting sound when the person speaking or the sound to be recorded is made several feet from the instrument.

Fig. 32 shows a device whereby the indenting point may be dispensed with in the phonograph. The funnel forming the phonograph is made with a diaphragm at the larger end or mouth-piece, and a very small hole at the pointed end adjacent to the foil on the cylinder g ; this foil should be very thin so that the indentations will be made by the direct action of the air waves as concentrated by the funnel without the interposition of the indenting point.

Fig. 33 shows a phonet in which the phonogram or sound record has been made upon an endless belt; this is a convenient arrangement for toys, as the same may be made to imitate the bark of a dog or other noise made by an animal; and this



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belt may be of steel or other hard material that allows the same to be used for a long period of time.

Fig. 34 is a perspective view showing a double phonet, there being a spiral line of indentations on each side of the revolving disk *d*, one phonet coming into action as the other finishes; in this case the spirals should be in opposite directions, so that the disk continuing to revolve in the same direction moves one phonet from the center outwards, and then the other phonet is connected and moved back towards the center; this may be used as a toy.

Fig. 35 represents a phonet in which the phonogram containing a sentence, speech, words, or other sound record is upon a belt or strip wound upon a reel; this belt is drawn along gradually and wound upon the second roller by any suitable mechanism, and as the phonogram is thus moved it actuates the phonet *c*, *b*.

Fig. 36 shows a phonograph or phonet similar to that shown in Fig. 12, the cylinder *q* is revolved, but remains in one position, and the phonograph or phonet is movable back and forth over the cylinder. In this instance the arm *m*² is extended beyond the screw *k*¹, and passes beneath the inclined spring guide *m*⁵, when the screw is carrying the arm and phonograph towards the right; as the arm *m*² passes from beneath the end of the guide *m*⁵ it is no longer held to the screw, and the arm *m*² and phonet are lifted by the guide *m*² as the springs *m*⁶ draws the shaft, phonograph, and arm, along to the place of beginning, at which place the arm *m*² drops off the end of the inclined guide *m*⁵ into the thread of the screw, and as this revolves it carries the arm along beneath the guide *m*⁵ as before.

Fig. 37 represents the phonograph or phonet upon a pivoted arm, so that it may swing across or at right angles to the line of movement of the intended material or phonogram. In this case the line of indentations may be lengthwise of the belt, or across the same in the arc of a circle.

Fig. 38 shows a phonograph similar to that shown in Fig. 31, except that the sound chamber is of a different shape.

Fig. 39 shows a mouth-piece with an orifice of soft rubber to fit the mouth or the lips of the person speaking, so that all sound waves will be confined to the chamber and diaphragm.

Fig. 40 shows the mouth-piece of the phonograph made with cross slots with irregular edges.

Fig. 41 shows the mouth-piece as perforated with numerous holes.

Fig. 42 shows but one opening in the mouth-piece; the edges of this are irregular. These irregular edges reinforce the lissing sounds and cause a more perfect phonogram to be produced.

Fig. 43 represents a mouth-piece of mica with a central opening protected at its edges by a wooden ring.

In Fig. 44, the diaphragm *b* is of wire gauze with a backing of paper connected to it by any suitable cement, and there is a ring of stiff paper at the edges of the gauze disk to strengthen it.

Fig. 45 represents a diaphragm *b* of parchment or similar material stretched tightly within the frame *b*⁶ by cords and screws. The cords may be of different lengths and tension, and respond to and reinforce certain sounds.

Fig. 46 shows a mouth-piece for the phonet made in imitation of the human mouth.

Fig. 47 represents the body portion of the phonograph or phonet made triangular, and the diaphragm is of corresponding shape.

Fig. 48 represents three cylinders, each provided with a phonograph or phonet; this is useful in recording and reproducing three-part singing or music.

Fig. 49 represents a phonet made as a tube, with flaring or trumpet shaped ends, and with two diaphragms 15, 16, placed crosswise of the tube so as to form an air chamber. There is a third diaphragm *b*, which is vibrated by the movement of the reproducing point *c*, and said diaphragm gives motion to the air in the chamber,

Edison's Improvements in Recording and Reproducing Sounds.

and vibrates the diaphragms 15, 16, which latter produce air waves, and the sounds issuing from the two trumpet-shaped ends will blend and increase the volume of sound.

Fig. 50 represents a device whereby deep indentations are made in the metal foil. Two diaphragms are employed, the first (b^2) is vibrated by the sound vibrations, and controls a valve b^7 in a tube connected with a source of compressed air or other fluid; this valve b^7 allows more or less air to pass to the diaphragm b , according to the vibration of the diaphragm b^2 , hence the diaphragm b will vibrate in harmony with the diaphragm b^2 , but it will be acted upon by greater force, and consequently the indentations will be deeper in the foil than if the diaphragm b was acted upon simply by the sound vibrations of the voice.

Figs. 51 and 52 represent a device that may be used with a phonet to increase the loudness of the sounds reproduced. The sound vibrations from the phonet are conducted by a tube shown by dotted lines in Fig. 51, to the diaphragm b^3 that controls a valve b^7 in a tube connected with a reservoir of air or other fluid under pressure, and the air as it escapes by the valve passes into the trumpet-shaped end of the tube, and produces sounds that are very loud and clear, and are a reproduction of the sounds resulting from the use of one of the phonets before described.

This same apparatus may be used to reproduce with louder utterances a person's voice, the sound from the voice being used to vibrate the diaphragm b^3 , and thereby regulate the air waves escaping from the valve b^7 into the trumpet.

Fig. 53 shows the speaker's head within a box or case; in this instance nearly all the sound vibrations act upon the diaphragm.

Figs. 54 and 55 illustrate how the movements of the lips in speaking may be recorded and reproduced. In this instance, a lever applied to the diaphragm carries the indenting point c , Fig. 55, and the end of this lever is placed in the mouth of the speaker, and the movement of the lips regulates the indentations in the foil.

A similar apparatus shown in Fig. 54 within a case is connected to the movable lips of a mask, so that these lips open and close as in articulation, at the same time that the sound vibrations are given by the phonogram to the phonet.

Fig. 56 represents a toy phonet in which the phonogram strip 35 is secured at one end to a cylinder upon which it is wound. By pulling upon the strip it is unwound, and a rubber cord 37 is wound upon the shaft of the cylinder. When the hand is removed from the indented strip, the rubber cord rotates the shaft and winds up the phonogram upon the cylinder, and the sounds are reproduced in the phonet by the phonogram acting upon a point and diaphragm a . The movement of the shaft is regulated by the fan, worm, and pinion 38.

In Fig. 57, the cylinder for moving the phonogram strip is shown as provided with pins that enter holes in the edges of the strip; this causes the strip to be fed along very regular.

In Fig. 58, the cylinder with pins is shown as made with heads to act as guides for the strip.

Fig. 59 shows a re-indenting device for amplifying or increasing the size of the indentations. There are two rollers, one of which a^2 travels faster than the other a^3 , and there is a lever 40 pivoted at 41, and provided with a point c for each cylinder. One point follows the indentations in the cylinder a^3 , and the other rests upon a^2 , and as this travels the fastest, the indentations made therein will be longer and also deeper by the point being at the outer end of the lever.

In Fig. 60, one roller 42 of the pair is made of hardened metal with the sound record in relief. This is obtained by electrotype or other process from an iron foil or other metal phonogram, and this roller is used to indent strips or sheets of foil or rollers to produce copies that can be used with the phonet.

Fig. 61 represents a roller 42 of hardened metal with the record in relief, and arranged so as to knurl or indent the phonogram in a roller 43 of soft metal that is to be pressed against the roller 42 by a screw or other suitable means.

The cylinder having a spiral groove in its surface may be made by placing the mould shown in Fig. 62 around a cylinder or shaft, and filling the space between

Edison's Improvements in Recording and Reproducing Sounds.

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the cylinder and mold with plaster of Paris or other suitable material. The mold is of metal with a screw or spiral rib projecting therefrom, and it is made in two parts and hinged so that it can easily be removed when the plaster of Paris is dry.

For amusement or instruction, the phonograph is capable of extended use; for instance, a revolving cylinder, see Fig. 63, containing rows of indentations representing the letters of the alphabet, and provided with keys containing corresponding letters, can be used in teaching the alphabet, and sentences, speeches, and other matter can be spoken by the phonet, and repeated by the learner without the eyesight being called into use.

Clocks may be provided with phonogram cylinders or wheels to call off the hours, to give alarms, &c.

The phonogram may be upon a strip, sheet, belt, or roller and it can be of a dog's bark, a rooster's crow, a bird's song, a horse's neigh, and these can be used in toy animals with a simple phonet for reproducing the sound.

In copying phonograms, or making duplicates, an original phonogram may receive a deposit of copper or iron in a plating bath; and, if of iron, may be carbonized to convert it into steel and hardened, and then the same should be backed up with type metal, and used for impressing strips or pieces of metal.

A bed of gutta percha, or similar material, may be used to sustain the sheet metal while being pressed. Numerous copies of the original phonogram can thus be reproduced.

A plaster cast can be used for producing a copy by pressure.

The governor to regulate the speed of the instrument may be made of a pendulum weight 61, see Fig. 64, hung at the lower end of a rod that is provided with a universal joint at 62, and the upper end of the rod is moved around by a crank 63 that is revolved by the train of gearing. As the speed increases the weight will describe a circle of larger diameter, and thereby increase the resistance.

The universal joint may be displaced by a spring wire, Fig. 65, that allows of the movement.

A magnet 64 upon the crank arm 63, Fig. 66, may be used to revolve the pendulum by attracting an armature at the upper end of the pendulum rod, and thereby avoid the friction resulting from the contact of the surfaces of the pendulum rod with the crank.

In Fig. 67 the diaphragm *b* is represented as connected to a pair of delicate piston valves within a tube 68 that has three ports; one, 69, is connected to a reservoir of compressed air, the others, 70 and 71, are connected to a number 72 at opposite sides of a diaphragm, so as to vibrate the same in harmony with the diaphragm *b*, but there will be greater amplitude given to the same by the pressure of the air, and by a connection to the phonet diaphragm *b*² the sound produced will be greatly increased.

What I claim as my Invention is,—

First. The combination with the diaphragm and point of a flat receiving surface and means for revolving the receiving surface, and causing the point to follow a volute or spiral line, substantially as represented in Figs. 1, 2, 6, 7, 8, 9, 10, and 34.

Second. The combination with the revolving plate phonograph or phonet of a propelling weight or spring and a governor to regulate the speed, and ensure uniformity of movement, substantially as set forth.

Third. A revolving disk provided with a clamping frame to secure the foil or other material in combination with the swinging arm, diaphragm, and point, substantially as specified.

Fourth. In a phonograph or phonet, a spring introduced between the diaphragm and the point, substantially as set forth and shown in Figs. 16, 17, 18, 19, 22, and 26.

Fifth. In a phonograph or phonet a rubber spring, or similar device, to dampen

Edison's Improvements in Recording and Reproducing Sounds.

the vibration of the diaphragm, and prevent false vibrations, as set forth and shown in Figs. 16 and 21.

Sixth. The combination with the diaphragm in a phonograph or phonet apparatus of a lever to modify the relative action of the diaphragm and point, substantially as described, and shown in Figs. 17, 18, 27. 5

Seventh. The combination with the diaphragm and point of a permanent or electro-magnet, substantially as described, and represented in Figs. 24, 25, 26.

Eighth. The method of recording and reproducing two or more sounds or speeches simultaneously, substantially as described, and as illustrated by Figs. 28, 29, and 48. 10

Ninth. A phonet composed of a perforated sirene and a jet tube, substantially as described, and represented in Fig. 30.

Tenth. The mechanism for producing a phonogram, and employing the same in a phonet, substantially as described, and illustrated in Figs. 32, 33, 35, 36, and 37.

Eleventh. The combination with the phonograph, diaphragm, and point of a sound chamber, substantially as described, and illustrated in Figs. 31, 38, 39, and 53. 15

Twelfth. The diaphragm and mouth-pieces for speaking phonograph, substantially as described, and as illustrated in Figs. 41, 42, 43, 44, 45, and 46.

Thirteenth. The combination with a diaphragm and its point of two diaphragms for the purposes, and substantially as shown in Fig. 49. 20

Fourteenth. The combination with a diaphragm and valve actuated by sound vibrations a source of compressed fluid and a trumpet, as in Figs. 51, 52, or a phonograph as in Fig. 50, substantially as set forth.

Fifteenth. The combination of two diaphragms with a valve and a source of compressed fluid, as represented in Fig. 67, for increasing the volume of the voice or other sound, as set forth. 25

Sixteenth. The combination with two or more phonograms of phonet keys for selecting letters or utterances as described, and illustrated in Fig. 63.

Seventeenth. The means for duplicating or reproducing phonograms from an original phonogram, substantially as set forth. 30

Eighteenth. The combination with the phonograph or phonet of the revolving crank and pendulum governor, substantially as described, and shown in Figs. 64, 65, 66.

Nineteenth. The combination with the phonograph of a lever moved by the lips, and of a lever and phonet to move the lips of a mask, substantially as described, and illustrated by Figs. 55 and 54. 35

Twentieth. The combination with a phonogram of a clock movement or toy and a phonet for reproducing sounds for clocks or toys, substantially as set forth.

In witness whereof, I, the said Thomas Alva Edison, have hereunto set my hand and seal, this 17th day of September, A.D. 1878. 40

THOMAS ALVA EDISON. (L.S.)

Witnesses,

CHAS. H. SMITH,

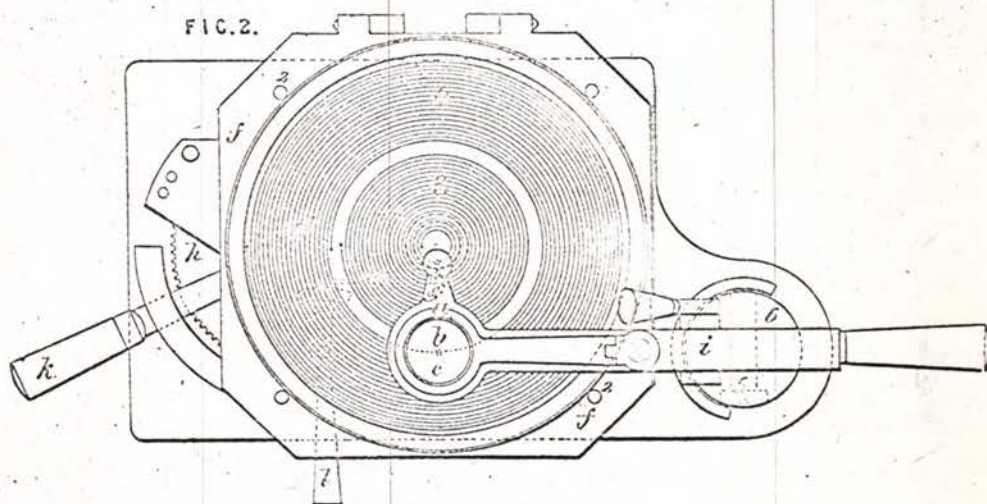
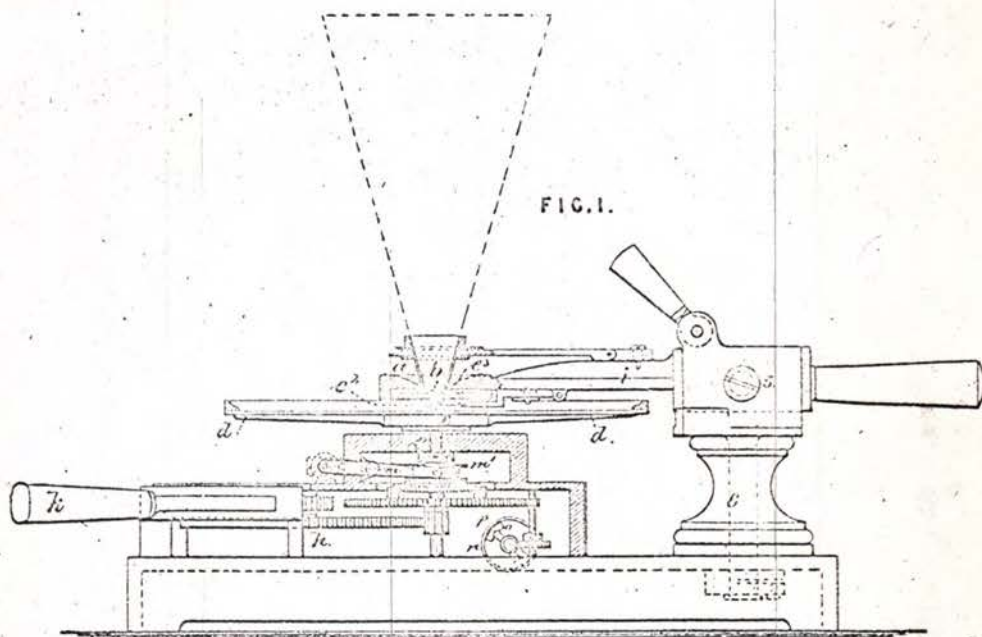
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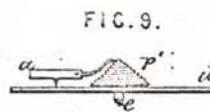
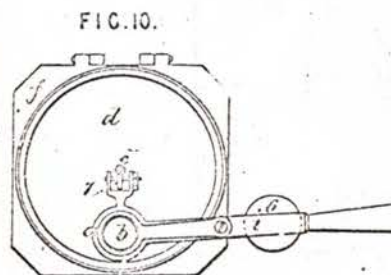
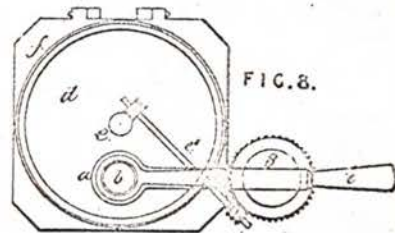
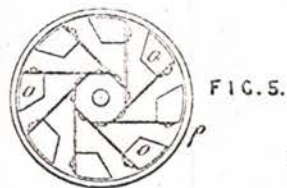
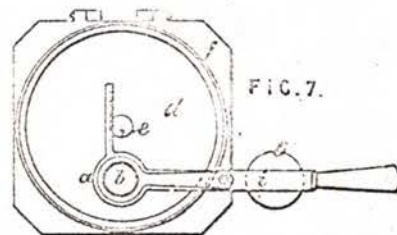
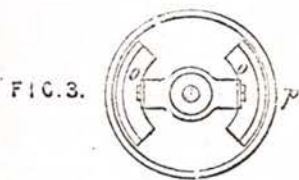
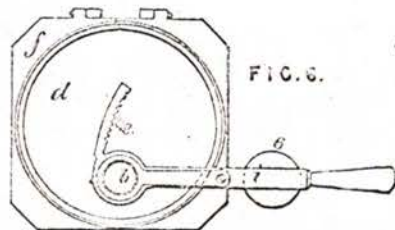
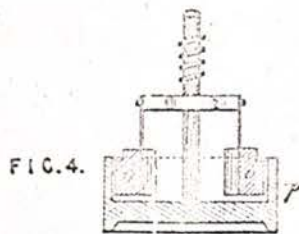
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For Her Majesty's Stationery Office.

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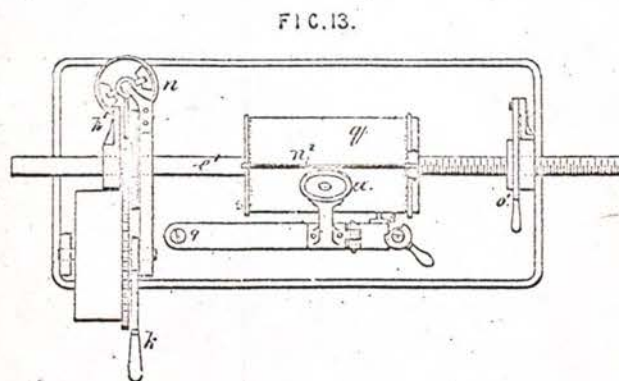
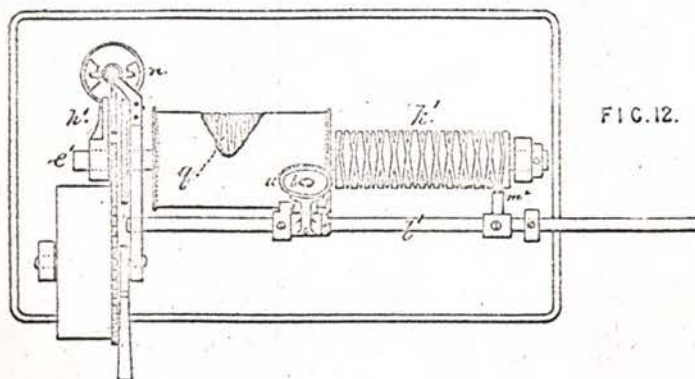
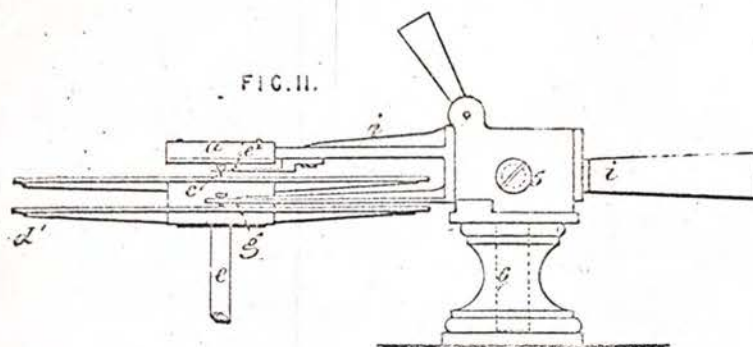
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EDISON'S SPECIFICATION.



Printed by J. H. Johnson, 101 N. 2nd St., Phila., Pa.



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FIG. 14.

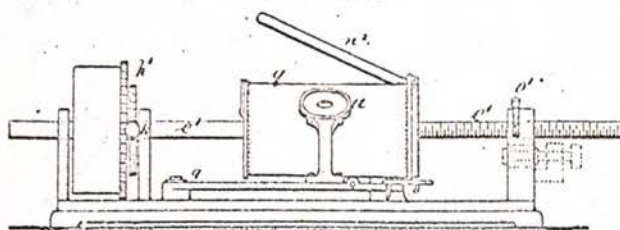


FIG. 15.

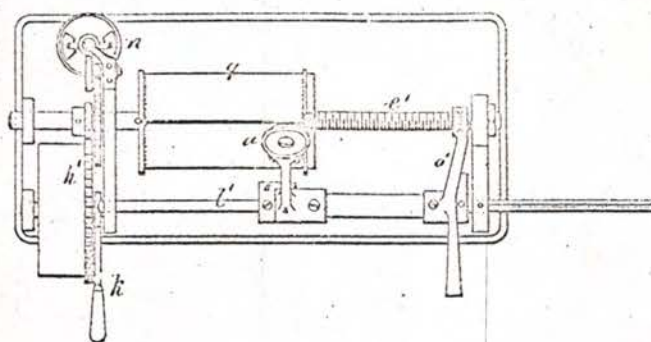


FIG. 16.

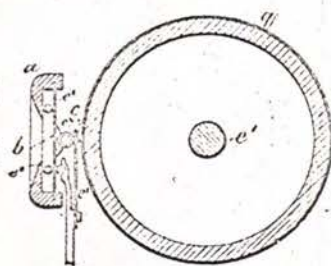


FIG. 17.

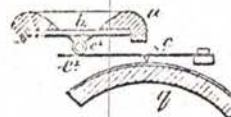
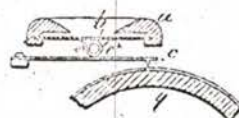
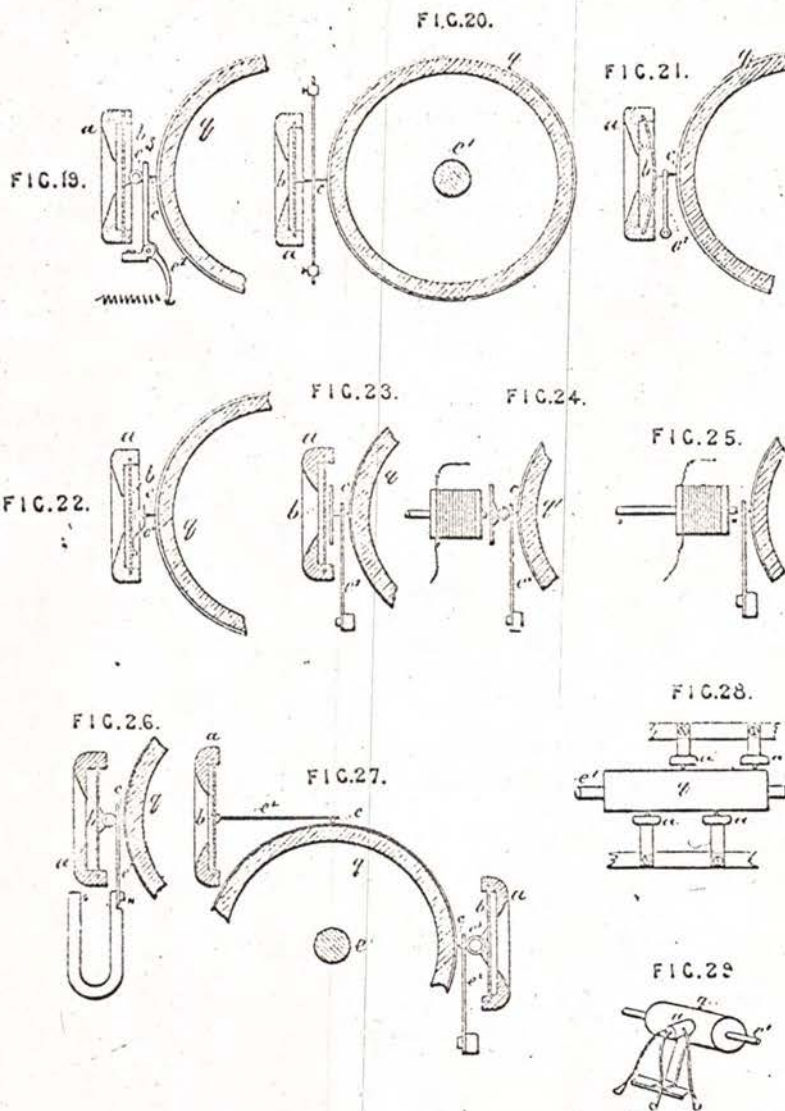
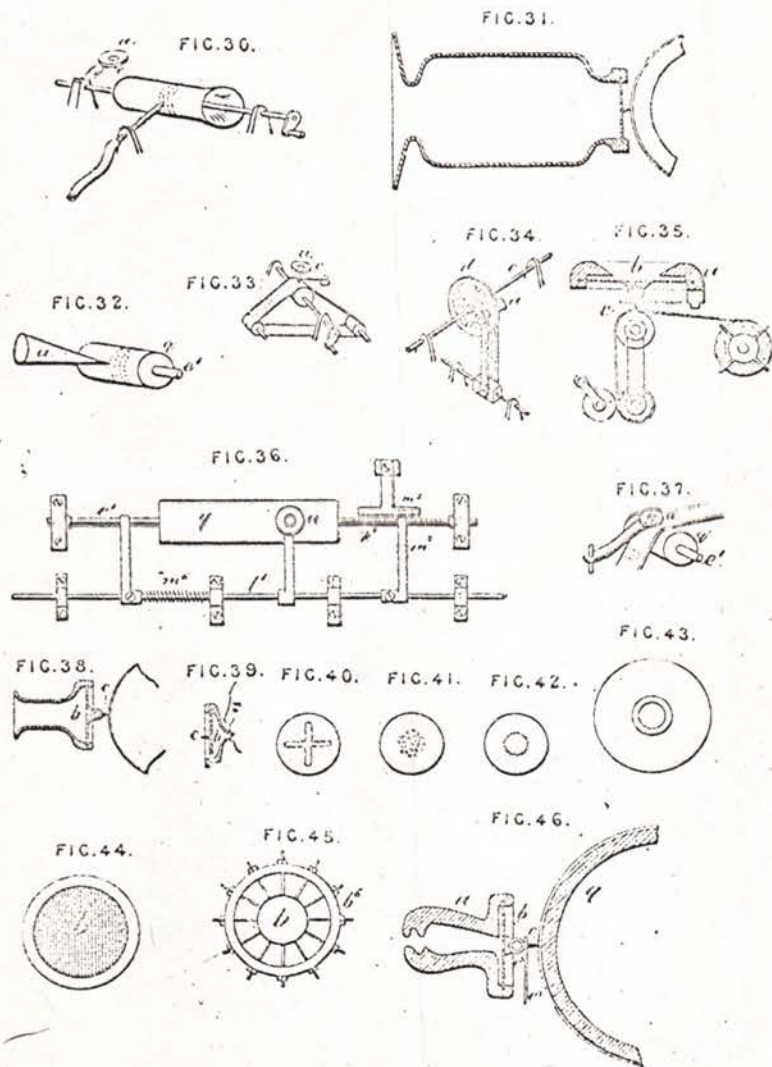


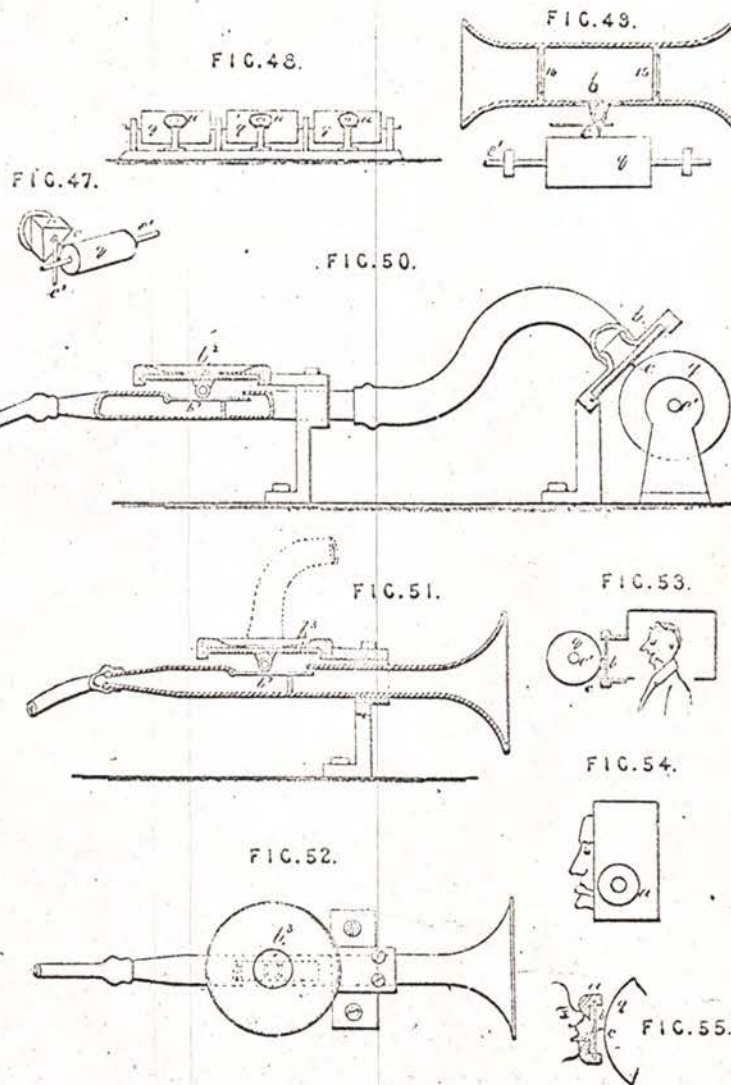
FIG. 18.



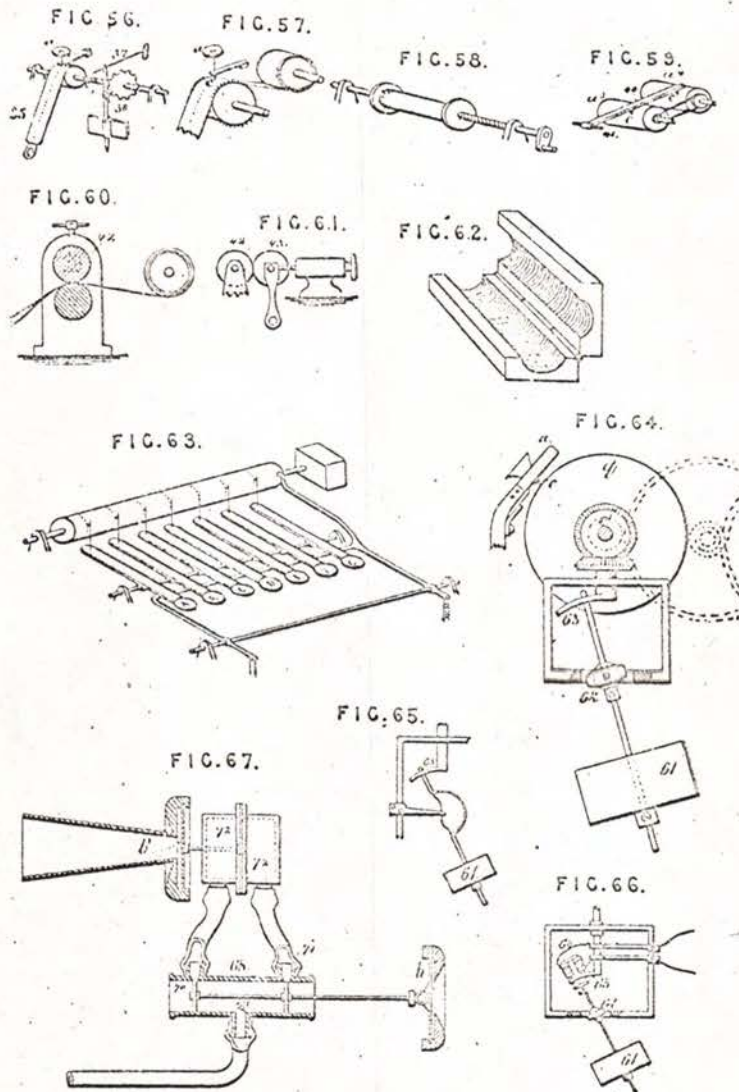




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EDISON'S SPECIFICATION.



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[Fifth Edition.]

Defendants Exhibit No. 12.

This Specification was, upon the 7th day of October 1890, amended under Sections 18 to 21 of the Patents, Designs, and Trade Marks Act, 1883.

[The Amendments are shown in erased and italic type.]

N° 6027*



A.D. 1886

COMPLETE SPECIFICATION (AMENDED).

[Communicated from abroad by The Volta Graphophone Company, of Alexandria, Virginia, in the United States of America.]

Improvements in and Apparatus for Recording and Reproducing
Speech and other Sounds.

I, JAMES YATE JOHNSON of 47 Lincoln's Inn Fields in the County of Middlesex Gentleman do hereby declare the nature of this Invention (which has been communicated to me from abroad by the Volta Graphophone Company of Alexandria Virginia in the United States of America and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:--

This Invention relates to the formation in a solid substance of elevations and depressions or other inequalities corresponding more or less perfectly to the forms of sound vibrations and the reproduction by means of such inequalities of the sounds represented by them.

The invention consists first in the formation of the record or "Phonogram" as it has been called by means of a cutting style which is vibrated by the sound waves, or sonorous vibration to be recorded. The vibrations may be impressed upon the style directly by the impact of the sound waves upon some device mechanically connected with or carried by the cutting style or its support or indirectly through the action of an electric current or other suitable vibratory medium.

Heretofore a large number of contrivances have been devised for converting electrical impulses into mechanical vibrations and they could of course be used for vibrating the cutting style otherwise they have no relation to this part of the present invention the essential new feature of which is the removal of material to form the record by a cutting, gouging or graving action of the vibrating style.

Heretofore the vibrating style has, as in Edison's well known Phonogram, simply indented the recording material. It has been proposed to cut the record in the edge of a strip of metal or other solid material by vibrating the strip in contact with the cutting edges of a rotary disc cutter, but this proposal is essentially different from this Invention; the new mode being applicable to cutting the record upon all sorts of surfaces and not upon strips only. Under this part of the

[Price 8d.]

Johnson's Impts. in and Apparatus for Recording and Reproducing Speech, &c.

Invention are included the vibratory cutting style as a new device in a sound recorder, and a combination of the same with other devices; also the cut or engraved record itself.

In this new or improved form of Record not only may a larger number of words or sounds be recorded in a given surface than has been practicable with the indented records heretofore in use but the recorded vibrations are also sharper and better defined.—It is found that an indenting style smooths over the crests of the larger elevations and also rubs out some of the finer ones.

The Invention consists secondly in engraving or cutting the Records in a waxy waxy or amorphous and slightly cohesive substance. Preferably a compound of beeswax and paraffine (the latter in excess) is employed—This compound has no tendency to clog the style but is readily removed thereby in chips or shavings. This part of the Invention also consists in includes a recording material composed of a wax or waxy surface on a paper or pastboard foundation.

Heretofore it has been proposed to use soft paper saturated or coated with paraffine as the material for recording by the indenting method but its use does not appear to have been successful and an outer layer of tin foil was therefore employed to receive the indentations.

The Invention consists thirdly also in cutting or engraving the record in the form of a groove with sloping walls the sound waves being represented by elevations and depressions at the bottom of the groove or otherwise. The advantage of this form of record is that it forms an efficient guide to the reproducing style.

The invention consists fourthly in loosely mounting The reproducing style *should be mounted* so that it can readily be guided by the record. This may be accomplished in different ways as for example by mounting the head of the reproducing instrument upon a joint which admits of a lateral movement, or the style may be so mounted as to be capable of a lateral movement independently of a diaphragm and other parts of the reproducer.—By this latter arrangement the style can accommodate itself to the record without having to put in motion the larger mass of the head of the reproducer. It therefore responds more quickly—Both arrangements will be illustrated.

In order to allow the reproducing style the greatest freedom of side movement while insuring its return to a central position and without impairing to a serious extent its rigidity in other directions a comparatively broad and thin strip of spring metal placed on edge is connected with or forms part of the reproducing style—Such a strip is very flexible to side pressure but comparatively rigid to other pressures. The strip is fastened to the diaphragm or to the device upon which it is desired to impress the vibrations or it is otherwise hinged so that it can impress vibrations on said device, or said strip may be rigidly connected with the frame of the reproducer and the style be flexibly connected with the outer end of the strip.

Preferably the reproducing style is fastened to the end of a thin metal strip parallel with the width thereof so as to form a hammer like arrangement the style being the hammer head. It is a pin or wire several times as thick as the metal strip. The vibrations are transmitted through the hammer head the actual strip being attached to a spring or it may be otherwise hinged to the frame of the reproducer.

The reproducing style mounted as just explained, is specially adapted for use in connection with a Record in the form of a groove with sloping walls and this combination is specially claimed but it may also be usefully employed in connection with other forms of record.

The invention consists fifthly in Reproducing *may be done* directly from the wax record. It is found that such a record has sufficient strength to withstand the rubbing action of the reproducing style so that a considerable number of reproductions can be obtained from it. The smoothness of the wax gives it a great advantage in this respect—It is believed that heretofore no one has reproduced sounds from a wax record by rubbing a style or reproducer over it.

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The invention consists sixthly in transmitting the vibrations of the reproducing style *may be transmitted* through a diaphragm, ~~a~~ or plate or other body of hard rubber. This material is found to give out purer sounds, the minute foreign vibrations being absorbed to a greater extent than with mica or metal, either of which and other materials also can under proper conditions be used with intelligible results.

The invention consists seventhly in cutting the sound record *may be cut* in a fusible material the waxy compound before referred to for example and then melting the surface *be melted* slightly so as to remove any roughness left by the cutting style; these roughnesses are altogether outside of the sound vibrations and give rise in reproducing, to scraping noises which interfere with the intelligibility of the sounds reproduced. These scraping noises are greater with some other modes of reproducing which will form the subject of other Patents, than they are with a rubbing style, but even with the latter the additional smoothness given to the surface by the partial fusion has some advantage.

The invention consists eighthly *also* in a sound recorder having a cutting or graving style which is held by elastic or yielding pressure against the surface on which the record is to be made. The object is to enable the vibratory graver or cutting style to ride over instead of ploughing through any elevations on the recording surface—The depth to which the point of the cutting style is embedded in the Record affects the amplitude of the style's vibration. By this Improvement the depth is kept uniform notwithstanding any slight unevenness of the recording surface.

The whole pressure of the Recorder may be borne by the style but there are advantages in combining with the recorder a rest which bears upon the recording surface or Tablet as it is called in this Specification and relieves the style of the greater part of the weight. The use of the rest enables a shallower groove to be cut effectively and also a lighter and more sensitive mounting of the style to be made. The style projects beyond the rest. To regulate the depth of out the rest is made adjustable.

In order to secure the most sensitive mounting for the recording style the latter is made from a short piece of wire and is attached directly to a diaphragm so as to be carried thereby; the means preferably employed being a screw thread on the style a nut of hard rubber engaging the same and a disk or washer of hard rubber between which and the nut the diaphragm is clamped.

The invention consists ninthly *also* in having the recorder of whatever description or the producer or both rest against the tablet or recording material by gravity.

The invention consists tenthly in combining *There may be combined* with a sound recorder or reproducer of any suitable description, a tube or hollow standard on which the recorder or reproducer is mounted and through which the sound waves are conveyed. This part of the invention ~~also consists in supporting this hollow standard~~ *may be supported* on a hinge and having *have* a sound conveying tube communicate with the interior thereof through the hinge—~~Also in the use of a~~ *There may also be used* a double ear piece for listening to the reproduced sounds and ~~of~~ a stop cock for modifying the loudness of these sounds. The double ear piece is somewhat similar to a Stethoscope—It consists of two elastic and flexible hollow branches provided each with a cup fastened to the branch by a ball and socket joint. The cups fit over the ears and are held against the head by the elasticity of the branches the universal joint allowing each cup to adjust itself to the head of the user. The stop cock is placed in the sound conveying tube between the reproducer and the ear of the listener so that by partially closing the same more or less of the sounds can be cut off as desired. Where more than one person is listening each of the sound conveyors may have its own stop cock.

The invention consists eleventhly in combining *Combined* with the Recorder *there may be* a mouth piece so shaped as to include the nose of the user. It is found desirable to concentrate the sound waves as much as possible upon the recording instrument or style and if an ordinary mouth piece be used the sound reproduced in the Record is imperfect in the nasal elements and is somewhat like the speech of a person with a cold in his head. By the use of the improved mouthpiece this disagreeable quality of the reproduced sound is avoided. The sound conveyor or concentrator

Johnson's Impts. in and Apparatus for Recording and Reproducing Speech, &c.

preferably used consists of a flowing mouthpiece of elliptical or oval section which covers the nose of the user and a tapering tube forming a continuation thereof which serves to amplify and reinforce the sound waves. It is found that the longer this tube is within certain limits the greater its reinforcement of the sound waves but that a too great length gives a hollow effect as when words are spoken into an empty barrel.

For the sake of lightness it is preferable to make the mouthpiece and tube of thin sheets of hard rubber or of paper or the like material—Metal mouth pieces and tubes have also been used with good effect.

The Invention consists twelfthly in combining With the reproducer *may be combined* a brush which bears upon the tablet and sweeps the record in advance of the reproducing style. Where the record is cut in wax the little shavings or chips are apt to cling to the record and have to be brushed off before reproducing—This can be done by hand, but it is not desirable to rely wholly upon hand brushing as too much care would have to be exercised to ensure that no particles adhere. The record is also liable to collect dust.

The Invention consists thirteenthly also in combining, with a recording and reproducing apparatus, in which the record is formed on the face of a disc in a volute or spiral by cutting or otherwise by any known or suitable means mechanism for giving to said disc an uniform surface speed under the recorder.

Heretofore when the Record was formed on the face of a disc the latter has been given an uniform rotation so that the same number of words were recorded in the outermost circle as in the smaller inner ones. By giving to the disc an uniform surface speed under the Recorder or by making the times of each rotation inversely proportional to the distance of the Recorder from the centre of the disc, the record of any given word or sound will be of the same length at whatever part of the disc it may be, and in this way it is possible considerably to increase the number of words or sounds on a given area.

The Invention consists fourteenthly in a The recording tablet is preferably composed of a hollow Cylinder or tube of paper or other suitable material coated with wax or wax like composition, preferably a compound or mixture of beeswax and paraffin—The Record is cut in the coating. The advantages of this form of tablet are that it may be very light while having sufficient stiffness to retain its form and avoid the danger of cracking the coating, it is compact and adapted for transmission through the mails or otherwise, the recording surface is continuous and it can very readily be placed on and removed from the holder by which it is supported and rotated in recording and reproducing.

The Invention consists fifteenthly in A new tablet holding mechanism.—The tablet holder is made in the form of a Cylinder over which the tubular tablet can be forced or slipped and from which it can be removed as desired. This Cylinder may be solid but for lightness it is preferably made hollow—It is of metal or may be of other solid material. It is journaled in bearings and is provided with a Crank or other means for rotating the same.

In order to support the tablet holder in the most solid manner it is provided with a journal at each end and these journals and bearings are constructed to prevent end motion. It is most detachable from its support at one or both ends in order to permit the placing and removal of the tablet—It will be understood that any ordinary or suitable means may be used for this purpose but it is preferred to use the means next to be described.

To facilitate the placing of the tablet on the holder and its removal therefrom and to avoid the removal of the tablet holder from the machine frame when this operation is performed a ball journal fitting in a cup or socket bearing, is employed at one end the other end being made detachable from the machine frame so that the holder can readily be tipped up and held in that position while placing or removing the tablet. The ball journal and socket bearing prevent end motion of the tablet holder,

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With the detachable device which in such a way

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The mechanism of the table translating recorder form of it has a constituent

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The machine without putting the

45 instrument machine machine reproduce steadiness

50 This paragraph well as a action the to the beginning record which uniform speed

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With the object of further facilitating the placing and removal of the tablet the detachable end of the tablet holder is held down by means of a catch or other device which can readily be released and a spring is combined with the holder in such a way as to raise the detachable end thereof when the catch is released.

- 5 The journal at the detachable end of the Tablet holder instead of resting directly upon the machine frame or a bearing attached thereto, is provided with a box or sleeve which fits over the journal and forms the bearing therefore. This box or sleeve remains on the journal when it is detached and protects it from dirt as well as prevents the lubricant on the journal from soiling the hands of the person using the machine. The spring for raising the holder acts upon this box (a rod being interposed) and the journal is relieved of its pressure. Another advantage which the use of this box or sleeve gives is that if the two bearings in the machine frame are not precisely in line the box or sleeve may adjust itself properly without joining the journal. The very slight space which always intervenes when two
10 separate pieces rest in contact will suffice to compensate for the very slight irregularity in alignment which a careful workman would leave.

- The invention consists ~~sixteenthly~~ in *There is also provided* new or improved mechanism for supporting the recorder or reproducer and moving it across the face of the tablet (radially if a disc, or longitudinally if a Cylinder) so that by the combined
20 translating motion of the Recorder or reproducer and the rotation of the tablet the recorder traces, and the Reproducer follows a spiral line on the tablet. This general form of instrument is known as well as that in which the tablet (disc or Cylinder) has a combined rotatory and translatory movement and ~~these improvements constituting the present invention~~ are mostly applicable to both forms; but some of them as those of this ~~sixteenth~~ part of the invention are limited to the form in which the recorder and reproducer have a translatory movement by means of a feed screw. To enable the Recorder and reproducer to be readily applied to and removed from the screw so that one screw can be used for both instruments, they are each provided with a divided or partial nut which engages the screw. To prevent the
25 instrument from being disengaged accidentally a guard is or may be provided which can be slipped under the screw when the instrument is in place or be withdrawn when it is desired to remove it. Both the reproducer and the Recorder may have such a guard but practically it is more important for the Recorder.

- Instead of having the recorder and reproducer mounted upon a slide moving in
35 ways or guides and connected with a screw for moving the same, they are mounted on a carrier which is not only engaged by said screw but supported by the same so as to be moveable lengthwise of the screw and capable also of turning on it as on a journal. Thus devices heretofore considered necessary are dispensed with and a movement of the recorder or reproducer towards and away from the tablet is
40 provided for.

- The invention consists ~~seventeenthly~~ also in mechanism whereby the operation of the machine can be stopped temporarily. To enable this to be effected instantly, without stopping the main shaft of the machine, mechanism is provided for putting the feed screw out of action and at the same time automatically lifting the
45 instrument clear of the record—Heretofore it has been necessary to stop the machine entirely. This is not desirable because in stopping and restarting the machine a difference in speed which appears on the record or in the sounds reproduced is almost certainly made, particularly where a fly wheel is used to give steadiness of motion.

- 50 This part of the Invention also comprises means whereby a word or sentence or a paragraph can readily be repeated when desired. To effect this a reversing as well as a stop mechanism is employed so that by bringing said mechanism into action the motion of the reproducer is reversed and the instrument is brought back to the beginning of the part to be repeated being meanwhile lifted clear of the
55 record which continues or may continue to revolve in the same direction at an uniform speed.

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The invention further comprises certain special constructions, combinations and arrangements of parts as hereinafter set forth.

Having now explained the principle of the Invention, the manner in which the same is or may be applied will now be explained with reference to the accompanying drawings which make part of this Specification.

Fig. 1 is a plan view of an apparatus constructed in accordance with the Invention arranged for recording sound upon the face of a disc. Figures 2 and 3 respectively a front elevation and cross section of the same—Figure 4 a view in section and elevation of the recorder. Figures 5 and 6 views on an enlarged scale of the graver or cutting style. Figures 7 and 8 views in elevation and section 10 respectively of the Reproducer. Figures 9 and 10 similar views of another form of reproducer and Figure 11 an elevation of the sound conveying tube for use with the reproducer.

Figures 12—17 represent a modified form of the disc apparatus Figure 12 being a back view partly in section Figure 13 a plan partly in section Figure 14 15 an edge view partly in section. Figures 15 and 16 views in elevation and section of the Recorder and Figure 17 an edge view of a friction clamp making part of the apparatus. Figures 18 and 19 are plan and longitudinal sections respectively of a form of apparatus also constructed in accordance with the invention in which the Record is made on a strip and figure 20 a plan partly in section of the reproducer 20 for use with such apparatus. Figure 21 is a view of a Recorder in which the style is operated electrically.

Figure 22 is a plan view of a machine or apparatus constructed in accordance with the invention or in which the record is made on a Cylinder. In this view the reproducer is shewn in place and the Recorder omitted. Figure 23 is a vertical 25 cross section of the same apparatus in elevation looking to the right in Figure 22. Figure 24 a section in the plane of Figure 23 but in elevation looking to the left, the Recorder being shewn in place and its mouth piece being broken away. Figure 25 a view similar to Figure 24 but with the reproducer in place instead of the recorder. Figure 26 a partial vertical longitudinal section on line *x x* of 30 Figure 23—Figure 27 an elevation partly in section of a part of the left end of the machine.

Figure 28 is an elevation partly in section of the Recorder its carrier and sound concentrator—Figure 29 a top view (on a reduced scale) of the sound concentrator of the Recorder—Figure 30 a central section of the Recorder in a plane at right 35 angles to those of Figures 24 and 28 shewing the base or carrier in elevation and figure 31 a section through the base or carrier of the recorder.

Figure 32 is a central vertical section of the reproducer its carrier and certain accessory parts. Figure 33 a face view of the Reproducer. Figure 34 a perspective detail view. Figure 35 a section through the base or carrier of the instrument. 40 Figure 36 a section illustrating a modified form of style. Figure 37, an elevation partly in section (on a reduced scale) of a listening device with double ear pieces and figure 38 a section illustrating another modification of the reproducer.

Referring to figures 1—11: A is the base or bed of the apparatus and B an upright frame which carries the mechanism for supporting and moving the tablet F 45 (shewn as a disc) on which the record is to be, or has been, formed—In the slide C moveable in ways of the frame B. is journalled an arbor D on which are fixed a metal disc E at one end and a bevel gear 1 at the other. The arbor projects beyond the metal disc E so as to form a support for the recording tablet F which is retained thereon by the nut 2 and washer 3. The metal disc E performs the 50 double function of a friction wheel and of a backing to the recording tablet F.

The bevel gear 1 engages a similar gear 4 on the end of the screw 5 which is journalled in a bearing in the slide C and is tapped through a stationary lug 6 on the frame B—As the arbor D is revolved the screw is turned also, and in consequence of its engagement with the lug 6 it moves the slide C lengthwise of 55 the frame B. The rotation is communicated to this arbour from the shaft 7 journalled in bearings of the frame B and provided at one end with a fly wheel 8

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and crank handle 9 and at the other end with a friction pinion G. This pinion is formed as shewn of rubber discs clamped together between metal washers—It bears against the back of metal disc E and communicates motion to it—As the slide C is moved by the action of the screw 5 the metal disc E is carried past the friction pinion so that it touches the metal disc in a spiral line and serves to give an uniform surface speed to each part of the disc as it in turn comes opposite said pinion.

The Recorder H is placed on the opposite side of the metal disc E preferably as shewn with the point of the graver or cutting style 11 directly opposite the point where the pinion G touches the disc E. The said pinion thus acts as a support to the disc against the action of the cutting or recording style—The latter is preferably formed of a round wire by turning the end conical and rounding the extremity and then grinding off one end to the axis of the wire.

This leaves sharp cutting edges on both sides of the tapering point. These edges remove the material in chips or shavings like a plane or turning tool. It is not essential to give this form to the style—Any form which will remove the material and not simply displace it will answer.

The style is set in one end of a block 12 provided on the opposite end with a cup 13 (see figure 4) and secured in the cross-piece 14 by the nut 15. The cross piece 14 is fastened to a ring 16 into which a back plate 17 is secured. These parts except the steel style are preferably of hard rubber although they could be made of other material, of brass for example.

A sound conveying tube 18 is screwed into the back plate 17 the end being just behind the cup 13. A diaphragm 105 of any suitable material whose edges are clamped between the ring 16 and back plate 17 is placed behind the cup 13 which is pressed against said diaphragm by the elasticity of cross piece 14.

The tube 18 forms part of a hollow standard upon which the recorder is mounted. The lower part 19 of this standard is hinged in the bracket 20 as clearly shewn in figure 2, so that it can be rocked to bring the Recorder into or put it out of action.

On the tube or standard 19 is a ring-weight Z which is retained in position by a set screw 127. It therefore can be adjusted up or down in order to increase or diminish the pressure of the style 11 against the tablet F. The use of this weight is desirable but not necessary.

The tube 21 communicates with the interior of the hollow standard through the hinge and does not therefore interfere with its freedom of motion. This tube 21 can be fixed in the bracket or can be allowed to turn as may be preferred.

The mouth piece I is shaped to fit the face of the user and is provided with a notch 22 to receive the nose. It is attached to the tube 23 which at its lower end fits snugly in the tube 21 and communicates through the series of tubes 23, 21, 19 and 18 with the space inside and back of the cup 13.

In operation the recorder rests by its own weight assisted by the pressure of weight Z, or by its own weight alone if preferred, against the recording tablet F, said weight causing the style to embed itself to the proper extent in the recording material—The sonorous vibrations impressed upon the style are so rapid as well as so minute that the record is made as perfectly as if the Recorder were held positively, while at the same time the recorder can be moved bodily to conform to the unevenness of the surface of the tablet and thus keep uniform the depth at which the style operates.

The tablet F consists of a paper or paste board foundation 24 with a coating 25 of wax—A composition excellently adapted to the purpose and according to experience the best, consists of one part by weight of white beeswax and two parts of Paraffine. The two bodies are melted together and if not perfectly free from dirt and grit should be filtered. A filtration through Cotton wool will answer. The coating is or may be about $\frac{1}{20}$ th of an inch in thickness (the paper being $\frac{1}{10}$ th of an inch more or less) and can be made by flowing the melted composition over the paper disc or foundation. The surface is preferably turned off flat on a lathe.

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In order to place the tablet in the machine the recorder H is turned back out of the way. When the tablet has been secured in place the recorder is turned forward into the position shown the style resting against and slightly penetrating the wax coating. A penetration of $\frac{1}{100}$ of an inch has been found very effective the style being formed of N^o. 16 wire shaped at the cutting end as in figures 5 and 6.

Upon turning the fly wheel 8 the disc E and tablet F will be turned and the style 11 will cut or engrave a spiral line in the wax coating of the tablet—If one talks into the mouth piece I the style will be thrown into vibrations corresponding to the spoken words and the engraved line will be of varying character the inequalities or variations from uniformity representing the forms of the sound waves.

The reproducer K shewn in figures 7 and 8 for reproducing from the engraved tablet or from other suitable record, the sounds which formed said records has a reproducing style 26 formed of a narrow metal strip bent near the end as shewn in Figure 8 and pointed as shewn in Figure 7. This style is held by cementing rivetting or otherwise, between the strip 27 and the circular plate 28 both preferably of hard rubber. The strip 27 is fastened at the bottom to an offset on the block 29 in which a passage is formed for the sound waves. This passage terminates just behind the plate 28. There is a fixed disc 30 of the same size as the moveable plate 28—It is cemented or otherwise fastened on the face of the block and is perforated at the centre in order not to obstruct the opening therein. The plate 28 is close to but not in contact with the disc. The tube 31 fixed at the upper end to the block 29 is joined at the lower end to the tube 33 by a section of soft flexible vulcanised rubber tubing 32. For use the tube 33 is slipped into the tube 19 in the manner shewn for the tube 18 of the Recorder.

The reproducer K when so placed is mounted upon a hollow standard composed of the tubes or tubing 31, 32, 33, and 19, and in consequence of the flexibility of the Rubber tubing 32 it is free to follow the Record. No special care is necessary to insure its adjustment for if the reproducer K be allowed to rest against the record with the style upon the engraved line, the style will of itself gravitate to the bottom of the groove.

There exists always a liability to disarrangement in some part of the machine either in the Recorder or the support therefor or the recording tablet or its support; or if there be no disarrangement it would be difficult to insure that the reproducing style should touch the record precisely at the proper point if the reproducer be held rigidly. Difficulties on these accounts are avoided by the loose or flexible mounting of the reproducer, the style automatically adjusting itself to the proper place on the Record. It will be seen that the reproducer is mounted on an universal joint so that it can move in any direction. The movement parallel with the face of the tablet would however by itself allow the style to follow and adjust itself to the record to a useful extent.

In operation the reproducer K is placed against the record and on turning the wheel 8 in the same direction and at about the same speed that it was turned in recording, the record will move the style 26 and plate 28 so as to throw the air in the hollow standard into vibrations and produce sound waves similar to those which originally acted upon the recording style to make the record.

The reproduced sounds are audible by placing the ear in proximity to the mouth piece I but it is preferred to withdraw said mouth piece and to connect the flexible tube 34 (see figure 11) with the tube 21 and listen at the ear piece 35.

After the record has been cut it will of course be understood that the machine is turned back to the starting point for reproducing.

The surface of the cut record can be rendered more smooth by removing the engraved tablet from the machine and exposing the surface to heat as for example by rotating the tablet face downward over an Alcohol lamp until the surface begins to glisten. Of course a too long exposure would destroy the Record—It is the merest surface action that is required. The record can be used for reproducing without submitting to this operation and without removing it from the machine.

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It may however be removed and at any time thereafter replaced on the same or a similar machine and be made to reproduce the original sounds.

The Reproducer K¹ shewn in figures 9 and 10 has the style 26 attached to the outer of two light plates 36 and 37 which are attached to a diaphragm 38 of thin sheet rubber clamped at the edges between the ring 39 and the border of the back plate 40. The tube 31 is fastened in the back plate.

It will be observed that in both forms of reproducer the style 26 projects beyond the edge or end of the instrument so that the position of its point on the record can be easily seen.

Referring now to figures 12—17 A is the bed B and upright frame D an arbour, E a metal disc, F the tablet and G a friction pinion as in Figures 1—11. The nut 2 and washer 3, the shaft 7 wheel 8 and crank 9 and the paper disc 24 and wax coating 25 are identical with the parts similarly numbered in Figures 1, 2 and 3.

The arbor D instead of being journalled in a slide is carried by an arm L which is supported by and is fixed on the short shaft 50. This shaft is supported on centres 51 and 52 so that the arm L can be rocked. The worm wheel 53 loosely mounted on the shaft 50 is held stationary by the clamp M the jaws 54 fitting on either side of the wheel and being pressed against it by the thumb screw 55.

The arbor D carries a screw wheel 56 which engages the worm pinion 57 at the upper end of shaft 58. The screw 59 at the lower end of the shaft engages the worm wheel 53. This shaft 58 and the gears 57 and 59 carried thereby prevent the arm L being turned independently of the worm wheel 53 except as the said shaft is rotated. As the arbor D disc E and tablet F are rotated the screw wheel 56 turns the shaft 58 and consequently the worm wheel 53 being held stationary by the clamp M the arm L is swung gradually to one side so that the recorder engraves a spiral line on the wax face of the tablet.

When the record has been cut it is only necessary in order to restore the tablet to the starting point for reproducing, to throw back the recorder and to loosen clamp M when arm L can be moved at once to the proper position.

A recorder constructed and mounted precisely as in figures 1, 2, 3, and 4 could be used in this machine but as shewn the recording instrument H¹ is modified to some extent. The cutting style 11 (which is the same as that of Figures 4—6) is set into a block 60 carried by a metal strip 61. This is fastened to a block 62 at the lower end of a back piece 63 which is attached to the upper end of the tube 64 which forms the hollow standard for the recorder and which is mounted on the bracket 65 so as to be capable of being turned to put the record into or out of action. The sound conveying tube 66 corresponding to tube 21 of Figures 1 and 2 communicates through the hinge with the interior of the tube 64.

In front of the opening at the upper end of tube 64 is stretched a diaphragm 67 of thin sheet metal or it may be of other material its edges being clamped between the ring 68 and back piece 63, soft rubber rings 69 and 70 being interposed one on each side of the diaphragm—On the opposite side of the diaphragm 67 from the tube 64 a light plate 71 of metal cupped in the centre is held against the diaphragm by the pressure of the strip 61 a projection on the back of said strip bearing against the said plate 71.

In this machine the reproducer K instead of being mounted on the same bracket as the recorder when the latter has been removed, is carried by a separate bracket 72 the tube 33 being hinged thereto so that the recorder and reproducer remain or may remain always attached to the machine, it only being necessary to turn one or the other into position as may be required.

Referring to figures 18—20, A is the base or bed B an upright frame 7 the driving shaft 8 the fly wheel 9 the operating crank handle and G the friction pinion as in figures 1 and 2. The arbor P is supported in an upright position in bearings of the frame A, B. and is revolved by the friction pinion G engaging the friction disc Q.

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The record is made on a wax coated strip of paper R which is passed around the periphery of the disc S in the groove formed therein—As the strip passes in front of the recorder or reproducer it is wound off one reel say the reel T and upon the other reel U. The strip can be wound back upon the reel T when desired. Each reel rests by its own weight upon a platform or flange 75 at the upper end of a hollow shaft 76 which turns upon a stand 77 fastened at the base to a bed B. A pin 78 passes through the centre of the reel and forms a journal for it to turn upon. A nut 79 holds the reel on and may be used to bind it with more or less tension. On each shaft 76 is a belt pulley 80 and 81 respectively driven by a crossed belt 82 or 83 from a pulley 84 or 85 on the Arbor P. These pulleys 84 and 85 are loose upon the arbor but are provided each with a clutch 86 and 87 so placed (see figure 18) that when the arbor is turned to the left the clutch 87 engages the hub 89 on the arbor and the pulley 85 is turned therewith while when turned to the right the clutch 86 engages the hub 88.

Each shaft 76 has a stop clutch 90 and 91 respectively, which holds it stationary when the strip is being wound on the other reel. Thus when the arbor P is turned to the left the reel U is revolved in the direction indicated by the arrow and the sleeve supporting reel T is held stationary. The strip is thus stretched at all times, the degree of tension depending upon the friction between the reels and their supporting flanges 75.

The recorder H¹ is carried by a cross piece 92 supported by posts 93. The style 11 is carried by a cross piece 94 to which it is attached by means of the cup 95 of hard rubber which forms a nut on the screw threaded shank of the style and said cup rests against a mica diaphragm 96 whose edges are clamped between the screw ring 97 and the back plate 98. The tube 18 screwed into the back plate is fastened by soldering or otherwise to the cross piece 92. The tube 23 of the mouth piece I fits into said tube 18. The ends of the cross piece 92 are slotted to fit around the screws at the top of posts 93 and rest upon nuts 99 and are clamped by nuts 100. By means of these nuts the vertical position of the recorder can be adjusted. After one line has been engraved on the strip the recorder can be adjusted to engrave as many additional lines parallel thereto as the strip will receive. The slots in the cross piece 92 allow the recorder to be moved towards and away from the strip so as to regulate the depth of the engraved line. To ensure a greater nicety of adjustment, screws 101 are tapped through the metal at the closed ends of the slots and bear at the point against the supporting screws. The Reproducer K¹ (Figure 20) is similar to that shewn in Figures 9 and 10 except that the style 26 is so placed that the point is at the centre instead of projecting beyond the edge of the instrument. Its position on the Record is therefore not so readily seen but with the form of machine shewn in these figures this is less important. The same may be said of the loose mounting of the reproducer although in point of fact the thin rubber diaphragm 38 gives a certain lateral play to the style. The tube 31 is rigidly fastened to a cross piece 102 identical with the cross piece 92 and with said tube 31 the hearing tube 34 and ear piece 35 are connected.

The paper strip can be easily coated with the beeswax and paraffin compound by running the same through a body of melted composition and scraping one side leaving what adheres to the other to harden thereon.

In figure 21 an arrangement for operating the recorder by electro magnetism is shewn. The magnet 107 is mounted on a bar 108 journaled in bearings in standards 109. It is provided with a bobbin 106 of wire surrounding the pole piece which bobbin is included in a circuit over which electrical undulations are caused to pass by any suitable transmitting instrument; for example such as commonly employed on Telephone lines.

In front of the pole piece or core of the bobbin is a diaphragm 105 of magnetic material whose edges are clamped between the ring 16 and back plate 17. The cup 13 should always be in contact with diaphragm 105 and be pressed against it

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by the spring of piece 14. This cup as well as the style 11 block 12 nut 15 and cross piece 14 is the same as in the Recorder H of figures 1—4.

Referring to figures 22—38 the frame of the machine as therein shewn consists of two upright side pieces 300 and 301 connected by tie rods 302 and 303 and the tube 304 which serves as a tie rod. The tablet holder 305 in the form of an elongated metal Cylinder is journaled in bearings at the top of the side pieces. The right journal 306 is ball shaped and rests in a socket (see figure 26) which permits the tablet holder to be tilted up, as indicated in dotted lines as well as to be revolved, while endwise motion is effectually prevented. The fly wheel 317 provided with a crank handle is mounted on a prolongation of the journal and serves to revolve the tablet holder. The left journal 307 which is or may be Cylindrical fits and revolves within a box 308, which is held in place on the journal by a screw 309 in the end thereof. The box 308 is confined between a seat on the side piece 301 and the hinged cap 310 which is held down by the spring Catch 311 (see Figure 27) fastened at the bottom in the plug 312 which is adjustably retained in position by the set screw 313. The catch can be released at will by a push pin 314. Below the journal 307 is a follower 315 fitting into and moveable in a hole in side piece 301 acted upon by the spiral compression spring 316 placed below it in the hole. The box 308 rests upon the top of the follower and relieves the journal of all pressure from the spring 316 when the cap 310 is held down by the catch 311. This pressure prevents the box turning. On releasing the catch 311 the spring 316 expands and throws up the journal 307 and the cap 310 as shewn in Figure 27. The cap can then be turned back and the tablet holder be tipped up and held in an inclined position by a hand on the fly wheel 317. The tablet consists of an elongated hollow Cylinder or tube 318 of paper or pasteboard (say one fortieth of an inch in thickness) coated with a layer about one thirtieth of an inch in thickness of a compound of one part by weight of white beeswax and two parts of paraffin. The beeswax and paraffin should be melted and stirred together and then filtered unless they are entirely free from sticks dirt and other foreign particles. The coating is or may be applied by stopping the ends of the cylinder partly immersing it in a bath of the melted composition and turning it therein one or more times, removing it and allowing the material to harden keeping it in motion meanwhile to prevent running then immersing and rotating it again and allowing the adherent layer to harden and so continuing until a coating of rather more than the thickness above indicated is attained. The surface is then turned smooth in a lathe, being supported on a Cylinder like the tablet holder 305. The tablet is then ready for use by placing over the holder or it may be kept until wanted—In keeping care should be taken to prevent access of dust.

After the tablet has been placed on the holder the detachable end of the latter is pressed down into its bearing and the cap 310 is engaged by the catch 311, which holds it down.

The record is made on or in the wax coating of the tablet by the instrument shewn in Figures 24 and 28—31. The diaphragm 320 (of Mica from six to twelve one thousandths of an inch in thickness) is held in a frame 321 between the flange 322 and a ring 323 of soft rubber tubing which is held down by the back plate 324 and screws 325 tapped into the frame. The heads of these screws project over the edge of the back plate. The recording style 326 formed of a steel wire (say $\frac{1}{32}$ of an inch in diameter) sharpened at the front or operating end like an ordinary round pointed turning tool and screw threaded at the other, is fastened to the centre of the diaphragm by the nut 327 and washer 328 which are on opposite sides of the diaphragm and clamp it between them.

The cutting edge of the style is preferably shaped to cut a groove of curved rather than of V shaped cross section—A bar 329 is hinged at one end to the frame 321 by a pivot screw 335 and at the other adjustably but rigidly fastened thereto by a screw 330—A second screw 331 bearing at the point against the top of the bar 329 assists in securing an exact adjustment and in holding the bar

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rigid—At the middle of the bar is an enlargement 332 which extends into close proximity to the recording style (see figure 30) and whose bottom is polished or made smooth so that it may bear upon the wax coated tablet and move over it without injury to the wax surface.

The frame 321 is provided with a base or carrier 333 in the form of a half nut⁵ In use this nut is supported and engaged by the rotatory feed screw 334 which is journaled in bearings in the side pieces 300 and 301. The base or carrier is elongated to give a sufficient bearing on the screw to prevent the tipping of the recorder sideways. To assist in preventing this and also to prevent the Carrier being lifted from the screw a guard is provided which consists of a block 335 10 attached to the end of a curved slide 336. This slide is guided by the piece 337 and can be turned from the position shewn in Figure 28, when the guard does not interfere with the placing of the carrier on the screw, into the position shewn in Figures 24 and 31 when it prevents the removal. The Carrier is however free to turn on the screw as on an axle so that the Recorder under the action of gravity 15 will press against the tablet the bar 329 forming a rest to support it. The recording style projects beyond the rest and enters the wax coating penetrating it a distance which is regulated by the adjustment of said rest or bar 329. The sound Conveyor consists of an elliptical mouth piece 338 and a tapering tube 339 both made for lightness of hard rubber in thin sheets say one thirty second of an inch thick— 20 A metal thimble 340 is attached to the small end of the tapering tube which fits over a tubular projection 341 on the back plate. The rotation of the feed screw 334 moves the Recorder lengthwise of the recording tablet and this movement in connection with the rotation of the tablet causes the style to trace a spiral line in the wax which line becomes a sound record by talking into the mouth piece 338 25 and thereby impressing sonorous vibrations upon the diaphragm and style—The style then cuts a variable line whose irregularities or inequalities correspond to the sound to be recorded. The spiral line can be omitted for a given distance when desired by simply lifting the recorder from the tablet. The feed screw 334 should be so mounted as to prevent endwise movement which would tend to make the 30 tracing line more or less zig zag.

As shewn a spring 342 (see figures 22 and 27) presses constantly upon the left end of the screw to keep it against the bearing at the opposite end. The feed screw is revolved by the friction wheels shewn in figures 22, 23 and 26—In recording the friction pinion 343 on the tablet holder communicates motion to the 35 large wheel 344 fast on the feed screw through the intermediate 345. Thus the feed screw has a much slower rotation than the tablet holder and the convolutions of the line traced on the tablet are much closer together than the threads of the feed screw—The intermediate 345 is mounted on the stud 346 (see figure 26) which is carried by a hinged frame so that the intermediate can be moved out of 40 contact with the pinion whenever it is desired to stop the feed without interrupting the rotation of the tablet holder. The hinged frame consists of side bars 347 which are hinged separately on the tie rod 302 and are rigidly connected with each other by tie bars 348 and 349—A spring 350 under each side bar tends to lift the frame and press the intermediate 345 against the pinion 343. The feed 45 screw is therefore normally in engagement with the tablet holder but can be disengaged at will by pressing upon the tie bar 348. The friction wheels 351 and 352 are for reversing the revolution of the feed screw. The wheel or pinion 352 is simply a hub on the side of the intermediate 345. The wheel 351 presses against the pinion 352 and is mounted on a stud at the end of bent 50 lever 353 which turns upon the screw stud 354 in line with the stud 346 (see Figure 26) The lever 353 thus turns about the axis of the wheel 352 and the wheel 351 may roll over the surface of the wheel 352 so as to be pressed against and thus engage the pinion 343 on the tablet holder.

The short arm of the bent lever is connected by a link 355 with the stud 356 55 itself secured fast to the side piece 300. When therefore the tie bar 348 and side bars 347 are depressed the lever (as shewn in figure 23) is turned to the left and

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when it is sufficiently depressed the wheel 351 is held against and engaged by the pinion 343. Motion is now communicated through the wheels 343, 351, 352, and 344 the rotation of the feed screw is reversed and a more rapid rotation is imparted to it. The carrier will therefore be moved backwards (to the left in Figure 22) more rapidly than it was advanced. There will ordinarily be not much occasion to use the stop and reversing mechanism in recording. It is for use in reproducing that it has been specially devised.

The reproducer (see figures 23, 25, 32, 33 and 34) has a style 357 welded or otherwise fastened to the end of a flexible strip 358 of thin steel (say one thousandth of an inch in thickness) so as to project beyond both edges of the same like a hammer head. The outer end of this style (which should be somewhat more tapering at the point than the recording style) rubs over the record or tablet; the inner end presses upon a light flat spring 359 fastened at the lower end to the frame 360 of the reproducer. The strip 358 is soldered into a slit of the ear 361 on the spring which by bending between the ear 361 and where it is attached to the frame 360 allows the style and strip to be moved in or out and thus serves to hinge the same to the said frame.

The diaphragm 362 of hard rubber about seven one thousandths of an inch in thickness is pressed against a central seat in the face of the frame 360 by means of the spring 359 between which and said diaphragm is a little block 363 of cork. It serves the double function of pressing the diaphragm against its seat and also of communicating vibrations to it. Cork is used because it is light and conveys vibrations well and has sufficient friction upon the diaphragm and spring to remain in the position in which it may be placed. By leaving it to be held by friction it can be adjusted by the user to give the best effects but it can be secured by cement or otherwise in the position which the maker or adjuster of the instrument may determine preferably it occupies a position intermediate of the style 357 and the edge of the diaphragm as shewn; but it can be set directly opposite the style.—In the former position there is a certain length of the spring 359 beyond the cork which length forms a tongue with a very high rate of normal vibration. It absorbs a considerable portion of the small vibrations which produce scratching noises and it thus makes the articulation more distinct. It also reduces somewhat the loudness of the sounds reproduced but the increased distinctness more than compensates for any loss in loudness. Another effect which the tongue has is to return the style more perfectly when it has been pushed out by an elevation on the record. It does this because its normal vibration is quicker than that of the diaphragm or because its amplitude of vibration is larger or for both reasons. It will be understood that this spring tongue is compressed by the weight of the reproducer which is sustained by the style. This weight is actually very small the frame being made for lightness of hard rubber but in comparison with the strength of the spring tongue it is considerable.

It will be observed that the diaphragm is strained by the spring in addition to the strain due to the weight of the reproducer.

The inner end of the style 357 preferably rests in a hole or recess in the spring 359 so that it is prevented from side motion bodily although capable of rocking on the inner end as a centre.—The bending of the strip 358 allows this side movement of the front end of the style to take place with the greatest freedom. A bodily movement of the style sidewise should be permitted if desired but a stop should then be used to prevent it from being pushed off the spring 359. To protect the style and other parts of the reproducer, a guard 364 is fastened to the front of frame 360 and is perforated at the centre for the passage of the style. On either side of the centre it is bent outward to form horns to support the instrument when placed face downward on a table or flat surface.

The reproducer consisting of the parts just described is mounted upon a hollow standard 365 which is hinged at the bottom to the carrier 366 by means of hollow trunnions 367 fitting in hollow uprights 368 on said carrier. The reproducer standard 365 is provided with a thumb piece 369 which can be pressed to hold up

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the reproducer in placing the carrier on and removing it from the feed screw 334. There are front and back screw stops 370 and 371 which limit the movement of the reproducer independently of the carrier. This latter is provided with a half nut to rest upon and engage the feed screw the same as the carrier of the recorder. It is not provided with a guard to retain it on the feed screw because it is considered unnecessary particularly when a flexible sound conveyor is employed as will presently be described. It is provided with a tail or prolongation 372 which rests upon the tie bar 348 (see figure 25) so that when this is depressed to stop or to reverse the feed screw the carrier will turn to the left (the centre of gravity being on that side of the feed screw) and automatically lift the reproducing style 357 from contact with the tablet 318 in or on which the record is formed.

When the tie bar 348 is released the springs 350 raise it and turn the reproducer and its carrier to the right so that the style again makes contact with the record. It will be observed that the pressure of the springs 350 does not force the style against the record because the reproducer is hinged to its carrier and only its very light weight comes upon the reproducing style and the record.

On the carrier is a brush 373 which when the reproducer is in motion bears upon the record and clears it of dust or shavings of wax or other lightly adhering matter in advance of the reproducing style.

The hollow standard 365 serves to convey sound from the lenticular chamber behind the diaphragm into the uprights 368 with the interior of which the coupling 374 communicates—To this coupling a flexible sound conveyor 375 is attached at one end the other end being connected with an upright branch of the tube 304. Thus the sound is conveyed from the interior of the uprights 368 through the coupling 374 and sound Conveyor 375 and tube 304 the flexibility of said conveyor 375 permitting the traverse of the reproducer as well as the turning of the carrier 366 on the feed screw 334.

The tube 304 communicates with tubes 376 and 377 one at each end of the machine. A hearing tube is or may be attached to either or both tubes. Preferably the apparatus shewn in figure 37 is employed. It consists of two elastic and flexible hollow branches 378 each provided at the outer end with a cup 379 attached by a ball and socket joint and a flexible sound conveying tube 380 for connecting both branches with the tube 376 or 377. As shewn there is a hollow metal coupling 381 at the free end of the flexible tube 380 of such exterior diameter as to fit snugly in the tube which is to receive it (see figure 25) This coupling is provided with a stop cock 387 which can be turned to cut off more or less sound if the reproduction is too loud. This diminution in loudness makes the scratching less distracting to a person with a sensitive ear.

In use the cups 379 are placed one over each ear of the listener the ball and socket joints permitting the cup to adjust itself to his head and the elasticity of the branches 378 drawing them with sufficient pressure to support the apparatus. The branches may be made of hard vulcanized rubber in order to secure the requisite flexibility and elasticity but it is evident that sound conveying branches having these qualities could be constructed of various materials and in various ways. Instead of applying the tube 380 to the tube 376 or 377 it may be connected directly with the coupling 374 the sound conveyor 375 being omitted. This has the advantage of diminishing the length of tube between the reproducer and the ear of the listener but is open to the objection that the reproducer is liable to be pulled from the machine by incautious movements on the part of the listener.

It may be observed that the reproduced sound may be listened to in various ways and that it is possible to perceive the sound by applying the ear close to the reproducer itself.

In the modified form of reproducer shewn in figure 36 the style 382 is made of a thin plate of sheet steel say three one thousandths of an inch in thickness of the form clearly shewn fastened on edge on the spring 359 being soldered in a slit in the ear 383 and a similar slit in the end of the metal end of the metal button 384

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which end projects through the spring 359. This button bears upon the hard rubber diaphragm 362 and serves to communicate vibration from the style to it.

In the form of reproducer shewn in Figure 38 the style 390 is interposed between the diaphragm 362 and the flat spring 391. Near each end the style has a rounded shoulder and the ends themselves are of smaller diameter so that they may pass through holes in the diaphragm and spring, as shewn the latter pressing upon the shoulders. The spring 391 whose flat side is towards the diaphragm is attached to the strip 392 which is soldered or otherwise fastened to the post 393.

The spring 391 retains the outer or operating end of the style in place while allowing it freedom to move endwise for impressing vibrations upon the diaphragm. Preferably it exerts a light pressure inwards tending to strain the diaphragm as well as maintain itself in contact with the shoulder on the style. It supplies the place of spring 359 of figures 32 and 36. The strip 392 whose edge is turned towards the diaphragm allows the operating end of the style to move sideways—
 15 It thus supplies the place of strip 358 of figure 32. and that which forms the style 382 of figure 36. The construction of Figure 38 has the advantage over the other forms that there is less material to be moved by the vibrations of the style. The parts 391 and 392 can most conveniently be made from a round wire by filing the same flat at proper points.

20 The operation of the machine has practically been explained in the foregoing description, in connection with the several parts of the machine but an explanation will now be given of the operation as a whole.

Having prepared a hollow paper Cylinder and coated it with the paraffine and beeswax composition, the coated Cylinder 318 (which forms the recording tablet) is placed upon the tablet holder 305 which for the purpose is detached at one end by releasing the catch 311 and tipped up as indicated in dotted lines in figure 26. The detached end of the tablet holder is then returned to its bearings in side piece 301—Having adjusted the rest 329 of the recorder so that the recording style 326 projects beyond the enlargement 332 the desired distance say five one thousandths of an inch the recorder carrier 333 is placed on the feed screw near the left end of the same, the guard block 335 is turned under the screw and the recorder is made to rest against the recording tablet, the weight being supported by the rest 329 and the style 326 penetrating the wax coating. The fly wheel 317 is then turned revolving the tablet holder and tablet and also but at a less speed the feed screw 334. Since the Recorder is moved lengthwise of the tablet as the latter is revolved under it the recording style traces or more specifically cuts in the wax coating a spiral groove whose convolutions are closer together than the threads of the feed screw. The convolutions may be eight one thousandths of an inch apart.

To make a speech record in or on the tablet the speaker places the lower part of his face in the mouth piece 338 and says in a clear and moderately loud voice the words to be recorded the fly wheel being kept in motion at an uniform speed of say one hundred and sixty revolutions per minute. If it be desired to mark visibly a paragraph on the record it can be done by lifting the recorder for a short time from the Record then releasing it and again speaking into the mouth piece. The sonorous vibrations which the speaker impresses upon the air in the mouth piece 338 and tube 339 are taken up by the diaphragm 320 and style 326 and the latter cuts a groove in the tablet which is correspondingly irregular. After the record has been cut over the whole tablet or as much as may be desired the recorder is removed. The tablet is also removed and brushed to remove the wax shavings and then or at some future time is replaced on the tablet holder of the same, or of a similar machine.

The reproducer carrier 366 is placed on the feed screw 334 the tail 372 resting on the tie bar 348. The thumb piece 369 of the reproducer standard is pressed upon to keep the style 357 or 382 from contact with the record until the carrier has been placed on the screw. It is then released and the reproducer falling forward brings the style into contact with the Record. Preferably the grooves are so close together that the ridge between them tapers to an edge on top so that no

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matter where the reproducer may be placed the style will enter a groove and being free to move sidewise will owing to the sloping sides of the groove penetrate to the bottom thereof under the action of gravity.

The fly wheel being turned at about the speed used in recording, the reproducer will follow the spiral groove cut by the recorder and will be acted upon by the inequalities or irregularities of the record and made to reproduce sounds or sonorous vibrations similar to those which acted upon the recorder to produce said inequalities or irregularities in the groove. Each elevation as it passes under the style at first presses the latter outward and when the top of the elevation is reached allows it to be returned inward by the tension of the diaphragm and spring or of the diaphragm alone. By these alternating movements repeated for each ascent and descent in the record and corresponding in extent and rapidity with the length and slope of the ascent and descent the diaphragm is thrown into vibrations corresponding in form to the sonorous vibrations which caused the irregularities or inequalities. In addition to these vibrations foreign vibrations due to various causes are also impressed upon the diaphragm. These should be disregarded as far as possible by the listener confining his attention to the speech vibrations. They will in the reproducer shewn in figures 32 and 33 be measurably taken up by the vibration independently of the diaphragm 362 of the tongue formed by the end of the spring 359 which projects beyond the block 363.

In certain speech sounds it is found that the diaphragm responds too sluggishly and that in consequence of this sluggishness the style, if influenced by the diaphragm alone, will not descend to the bottom of a depression in the groove but will skip across thus cutting off more or less of the vibration. The tongue of the spring 359 responds more readily than the diaphragm and diminishes the danger of false vibrations. This spring tongue also absorbs a portion of the speech vibrations thus diminishing the loudness of the reproduced sound; but any loss in this respect will be more than balanced by the improvement in distinctness. The vibrations of the diaphragm being impressed upon the air in the Chamber behind the same are conveyed through the standard 365 the uprights 368 the coupling 374 the flexible tube 375, the tube 304 the tube 376 or 377 the tube 380 and the branches 378 to the ears of the listener. Should it be desired to interrupt the reproduction for a time the tie bar 348 is pressed lightly thereby withdrawing the intermediate 345 from contact with the pinion 343 and stopping the rotation of the feed screw 334. At the same time the reproducer carrier 366 is allowed by the depression of the tie bar to turn sufficiently to lift the reproducer style 357 clear of the record, the front stop 370 coming in contact with the standard 365 and raising the same.

Should one or more words phrases or sentences not be understood the tie bar 348 is pressed more strongly so as to bring the wheel 351 into engagement with the pinion 343 and thereby reverse the rotation of the feed screw. When the reproducer has been carried back beyond the part of the record from which the reproduction was not understood the tie bar 348 is released the style again comes into contact with the record and the reproduction commences at the point to which the reproducer has been brought back. This repetition of what is not understood can be made as often as desired.

Friction wheels for communicating motion to the feed screw are preferred to cog or other toothed gearing (which could of course be used without departing from the invention) notwithstanding their liability to slip, because they run smoother and are more easily engaged and disengaged. A slip between the wheels causes the reproducer to be fed faster or slower than the spiral on the tablet permits the style to advance. As a general thing there is more slip in recording than in reproducing and consequently the reproducer outruns the style slightly. The style should be given enough side play to compensate for this difference in speed, but if not given the only difficulty is that the style will at length slip across the ridge between the grooves and thus escape the action of a portion of the record so that it may be necessary to bring back the reproducer by reversing the feed. The

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loudness of the reproduction is limited as desired by turning the stop cock 387 to the desired extent.

In the foregoing description of the machine shewn in the drawings, dimensions, proportions materials and other details of construction are mentioned with particularity for the purpose of enabling others more readily to make and use the new improvements and not as limitations of the said improvements since it is obvious that modifications can be made in details without departing from the spirit of the Invention and that parts of the Invention can be used separately.

The terms "recorder" and reproducer" as used herein, include simply, means, (a style for example) for acting upon a tablet to form a record or being acted upon by a sound record in connection with means whereby vibrations can be impressed upon the recording style or its substitute or can be received from the reproducing style or its substitute and such frame or support as may be necessary to an operative device.

As hereafter employed they mean a recorder or reproducer of any ordinary or suitable description unless a special form is mentioned or is necessarily implied from the connection in which the Recorder or Reproducer is used. For example some forms of recorder and reproducer would not be suitable for use with a wax coated tablet.

In like manner other terms such as tablet, tablet holder, carrier, sound conveyor, gearing, &c refer to devices of any ordinary or suitable description except as otherwise indicated.

A means has been shewn for impressing vibrations upon the recording style by an electrical current through the intermediary of an electro magnet in a manner similar to that in which the diaphragm of an ordinary receiving telephone has been vibrated. It is evident that other means heretofore used for vibrating a diaphragm could be used in place of the magnet also it is evident that the vibrations of the reproducing style could be taken up and transmitted by the means heretofore used for taking up and transmitting vibrations (those of a Telephone diaphragm for example).

Having now particularly described and ascertained the nature of the said Invention and in what manner the same is to be performed I declare that what I claim is:—

First. The method of forming a record of sounds by impressing sonorous vibrations upon a style, and thereby cutting in a solid body the record corresponding in form to the sound waves in contradistinction to the formation of sound waves by indenting a foil with a vibratory style, or cutting a strip by vibrating it against a revolving disc cutter; substantially as described.

Second. The method of forming a sound record by impressing sonorous vibrations upon a style in a direction at right angles to the recording surface and thereby cutting in a solid body a series of elevations and depressions of varying depth corresponding in form to the sound waves substantially as described.

Third. The vibratory cutting style of a sound recorder substantially as described.

Fourth. The cutting style in combination with a support permitting the same to be vibrated and means for impressing sonorous vibrations thereon substantially as described.

Fifth. A vibratory cutting style in combination with a sound conveying tube for concentrating the sound waves upon the style substantially as described.

Sixth. Second. A vibratory cutting style in combination with a tablet or other solid body in which the record is to be cut, and mechanism for supporting the same and moving it with reference to the said style substantially as described.

Seventh. Third. A sound record consisting of a tablet or other solid body having its surface cut or engraved with narrow lines of irregular or varied form corresponding to sound waves substantially as described.

Eighth. A sound record consisting of a tablet or solid body having its surface cut

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or engraved with a number of lines of variable cross-section, the irregularities or variations corresponding in form to sound waves substantially as described.

Ninth.—*Fourth.* The method of forming a sound or speech record, by engraving or cutting the same in wax or a wax like composition, substantially as described.

Tenth.—The sound or speech record cut or engraved in wax or a wax like composition substantially as described. 5

Eleventh.—The recording tablet of a Phonograph or sound recording machine having as the material for recording sounds or sonorous vibrations the composition of bees wax and paraffine substantially as described.

Twelfth.—The sound or speech record cut or engraved in a wax like composition such as the compound of beeswax and paraffine substantially as described. 10

Thirteenth.—A tablet or body for recording sound vibrations consisting of a paper or paste board foundation and a surface coating of beeswax and paraffine compound, substantially as described.

Fourteenth.—The sound or speech record cut or engraved in a wax like composition, such as the described compound of bees wax and paraffine constituting a surface coating to a paper or pasteboard foundation, substantially as described. 15

Fifteenth.—*Fifth.* The method of making a sound or speech record by engraving or cutting in the recording material an irregular groove with sloping walls the shape of the groove representing the sound vibrations substantially as described. 20

Sixteenth.—The method of making a sound or speech record by cutting in the recording material a groove with sloping walls and of variable cross-section the variation corresponding in form to sound waves substantially as described.

Seventeenth.—The sound record in the form of an irregular groove with sloping walls cut in solid material substantially as described. 25

Eighteenth.—The sound record cut in wax or wax like composition in the form of an irregular groove with sloping walls substantially as described.

Nineteenth.—The combination with the reproducing style of a mounting therefor which leaves said style free to move laterally and thereby adjust itself automatically to a sound record substantially as described. 30

Twentieth.—The reproducer loosely mounted on a suitable support so that the reproducing style is capable of a lateral movement and may in consequence thereof adjust itself automatically on the record substantially as described.

Twenty-first.—The reproducer mounted on an universal joint and held against the record by yielding pressure substantially as described. 35

Twenty-second.—The combination with a grooved tablet or other body having a sound record formed therein of a reproducer having a rubbing style loosely mounted so that it is free to move laterally and thus adjust itself to the groove substantially as described.

Twenty-third.—The combination with the tablet or other body having the sound record formed therein as an irregular groove with sloping walls of a reproducer having a style for rubbing over said record and mounted on an universal joint substantially as described. 40

Twenty-fourth.—The combination with a sound record formed in wax or a wax like material of a reproducer having a rubbing style for receiving sonorous vibrations from said record substantially as described. 45

Twenty-fifth.—A reproducer having a style projecting beyond the edge or end of the instrument so that the position of the point of the style on the record may be readily seen substantially as described.

Twenty-sixth.—In a reproducer the combination with a vibratory plate or diaphragm of a reproducing style fastened flatwise on said plate or diaphragm and bent at the end substantially as described. 50

Twenty-seventh.—The method of recording and reproducing sounds by cutting the record in a wax or wax like material and then rubbing over the record the style of a suitable reproducing instrument so as to impress sonorous vibrations on said style substantially as described. 55

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Twenty-eighth. The method of improving a sound record by producing an incipient fusion of the surface substantially as described.

Twenty-ninth. The improvement in preparing a sound record by cutting the record in a fusible material and then producing an incipient fusion of the surface substantially as described.

Thirtieth. Sixth. The sound recorder having a vibratory cutting style held against the recording material by yielding pressure substantially as described.

Thirty-first. The recording instrument having a vibratory cutting style and mounted on a hinged arm substantially as described.

Thirty-second. Seventh. The combination with the tablet or body in which the sound record is to be made, of the recording instrument mounted on a hinged arm and resting by gravity against the tablet substantially as described.

Thirty-third. The recorder mounted on a hollow arm or standard which constitutes also a sound conveyor substantially as described.

Thirty-fourth. The recorder mounted upon an arm or standard hinged to its bracket or base and provided with a sound conveyor extending lengthwise of said arm substantially as described.

Thirty-fifth. The recorder mounted upon a hinged arm and combined with a sound conveyor which extends lengthwise of the arm and is connected at the hinge with an exterior sound conveyor substantially as described.

Thirty-sixth. The reproducer mounted upon a hollow standard which forms a sound conveyor substantially as described.

Thirty-seventh. The reproducer mounted upon a hinged arm and provided with a sound conveyor extending lengthwise of said arm substantially as described.

Thirty-eighth. The reproducer mounted on a hinged arm and provided with a sound conveyor extending lengthwise of said arm and connected at the hinge with an exterior sound conveyor substantially as described.

Thirty-ninth. The combination with a sound recorder of a mouth piece shaped to surround the mouth and nose of the user and to concentrate the sound upon the recording device substantially as described.

Fortieth. Eighth. The combination with the tablet in the form of a disc and a recorder or reproducer of mechanism for causing a spiral line to be traced on the disc by the recorder or reproducer at a uniform surface speed substantially as described.

Forty-first. The combination with the tablet in the form of a disc, the arbor and the metal disc operating as a friction wheel, of a slide or its equivalent such as herein shewn in which said arbor is journaled and the friction pinion or revolving said disc substantially as described.

Forty-second. The combination with the recorder or reproducer, the disc, the arbor and the laterally moveable support to the arbor, of the friction pinion placed behind and bearing against the disc at a point opposite the recorder or reproducer substantially as described.

Forty-third. The combination with a recording style and the support therefor of a cup on the back of said support and the sound conveying tube terminating just behind the cup substantially as described.

Forty-fourth. In combination with the style of a sound producer, a vibratory body or plate of hard rubber upon which vibrations are impressed by said style and through which they are transmitted substantially as described.

Forty-fifth. A tablet provided with a wax like coating and having engraved in said coating a spiral line with inequalities or irregularities corresponding in form to sound waves substantially as described.

Forty-sixth. A tablet provided with a coating of wax or wax like substance and having a sound record engraved in said coating said engraved coating having the glazed surface which results from an incipient fusion after cutting or engraving the record substantially as described.

Forty-seventh. In combination with a sound recorder a flaring mouth piece shaped to fit over the face of the user and to include his nose and communicating

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through a tube or contracted opening with the space behind the diaphragm of said recorder substantially as described.

Forty-eighth. A recording tablet for a Phonograph consisting of a hollow Cylinder provided with a wax or wax-like coating for receiving the sound record substantially as described.

Forty-ninth. A recording tablet consisting of a hollow cylinder of paper provided with a wax or wax-like coating substantially as described.

Fiftieth. The recording tablet consisting of a hollow paper cylinder coated with a composition of beeswax and paraffine substantially as described.

Fifty-first. A tubular self-sustaining tablet for recording sounds or sonorous vibrations substantially as described.

Fifty-second. In a Phonograph and in combination with a sound recorder or reproducer and operating mechanism for causing the said recorder or reproducer to trace a spiral line on the tablet an elongated cylindrical tablet holder supported and journaled so that the tubular tablet can be placed on the same substantially as described.

Fifty-third. The combination with a tubular tablet of the tablet holder for supporting and rotating the same substantially as described.

Fifty-fourth. A tablet holder journaled in bearings at both ends and detachable from its support at least at one end so that a tubular tablet can be slipped over the same in combination with a sound recorder or reproducer and operating mechanism for causing said recorder or reproducer to trace a spiral line on the tablet substantially as described.

Fifty-fifth. A tablet holder detachably connected with its support at one end and provided at the other end with a ball and socket bearing or bearing which permits the said holder to be tilted for placing a tubular tablet on the same in combination with a sound recorder or reproducer and operating mechanism for causing said recorder or reproducer to trace a spiral line on the tablet substantially as described.

Fifty-sixth. The combination with the tablet holder the side piece or support at one end of the same and the cap therefor of the catch or fastening for said cap and the spring for moving the tablet holder when the catch is released substantially as described.

Fifty-seventh. The combination with the tablet holder and the ball and socket bearing or bearing for permitting the holder to be tilted, of the support and cap at the opposite end of said holder the catch or fastening for said cap and the spring for lifting the journal from said support when the catch or fastening is released substantially as described.

Fifty-eighth. The combination with the tablet holder of the box or sleeve on one journal of the same, the support and cap forming the bearing for said box or sleeve, and the catch or fastening for the cap substantially as described.

Fifty-ninth. The combination with the tablet holder of the box or sleeve held on one journal of the same, the support and cap forming a bearing for said box or sleeve, and the spring whose pressure acts against said box or sleeve substantially as described.

Sixtieth. The combination with the tablet holder of the ball journal and socket bearing at one end of said holder, the box or sleeve on the journal at the opposite end of said holder and the bearing for the same substantially as described.

Sixty-first. The combination with the tablet holder, the recorder and the feed screw, of gearing between said holder and feed screw for revolving the latter at a slower speed than the former substantially as described.

Sixty-second. The combination with the feed screw, of the carrier or the recorder or reproducer provided with a divided or partial nut for engaging said screw substantially as described.

Sixty-third. The combination with the feed screw and the carrier for engaging the same of the movable guard for retaining the carrier in engagement with the screw substantially as described.

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Sixty-fourth. The combination with a feed-screw of the carrier for the recorder or reproducer engaged and also supported by said screw substantially as described.

Sixty-fifth. The combination with a feed-screw of the carrier for the recorder or reproducer movable lengthwise of and engaged by said screw and capable of turning on the same as on a journal substantially as described.

Sixty-sixth. The combination with a tablet and tablet-holder of the feed-screw a carrier mounted on said screw and the recorder supported on said carrier and resting against the tablet substantially as described.

Sixty-seventh. The combination with the tablet-holder feed-screw and gearing between the same of the hinged frame upheld by spring pressure and the devices connected therewith for putting the feed-screw out of action substantially as described.

Sixty-eighth. The combination with the tablet-holder feed-screw and gearing between the two of the hinged frame upheld by spring pressure and reversing mechanism connected with said frame for reversing the rotation of the feed-screw relatively to the tablet-holder substantially as described.

Sixty-ninth. The combination with a tablet-holder, a feed-screw, gearing, and an instrument, (the reproducer for example) engaged by said screw of stop mechanism for putting the feed-screw out of action, and at the same time lifting the instrument clear of the tablet substantially as described.

Seventieth. The combination with a tablet-holder, a feed-screw gearing and an instrument, (the reproducer for example,) engaged by said screw of reversing mechanism for reversing the rotation of the feed-screw, the said mechanism being connected with said instrument so that the latter will be lifted clear of the tablet on the reversal of the feed-screw substantially as described.

Seventy-first. The combination with the tablet and the recorder held against the same by yielding pressure of a rest bearing on said tablet for supporting the recorder substantially as described.

Seventy-second. The combination with the recorder frame and style, and the means whereby sonorous vibrations are impressed upon the style of the rest attached to said frame and arranged close to said style the latter projecting beyond the rest to act upon the recording tablet substantially as described.

Seventy-third. The combination with the recorder of the adjustable rest attached to said recorder for bearing upon the recording tablet substantially as described.

Seventy-fourth. The combination with the recording style, the recorder frame and the means whereby vibrations are impressed upon the style of the rest attached to said frame and adjustable lengthwise of said style substantially as described.

Seventy-fifth. The combination with the recorder frame and the rest attached thereto, of the diaphragm and the recording style, mounted directly on said diaphragm substantially as described.

Seventy-sixth. The combination with the diaphragm, of the cutting style formed of a wire sharpened at its outer end and attached to said diaphragm so as to vibrate with the same substantially as described.

Seventy-seventh. The combination with the diaphragm of the cutting style provided with a screw-threaded shank, and the nut and washer for securing the same to the diaphragm substantially as described.

Seventy-eighth. The combination with a recorder having a cutting style, of the rest for bearing upon the recording tablet substantially as described.

Seventy-ninth. The combination with the tablet having a wax or wax-like coating to receive the record of the recorder pressed towards the tablet by yielding pressure and provided with a cutting style, and the rest for bearing upon the tablet and supporting said pressure substantially as described.

Eightieth. The combination with the recorder of the sound concentrator comprising a flaring mouthpiece and a tapering tube forming a continuation of the same substantially as described.

Johnson's Impts. in and Apparatus for Recording and Reproducing Speech, &c.

Eighty-first. The combination with the recorder of the sound concentrator comprising a mouthpiece of elliptical form and a tapering tube forming a continuation of the same substantially as described.

Eighty-second. The combination with the reproducer of the brush for cleaning the record in advance of the reproducer substantially as described. 5

Eighty-third. The combination with the recording tablet having a wax or waxlike coating in which the record is cut, of the reproducer and the brush for cleaning the record in advance of the reproducer substantially as described.

Eighty-fourth. A recording tablet consisting of a hollow cylinder provided with a wax or waxlike coating and having a sound record cut in said coating substantially as described. 10

Eighty-fifth. The combination with the tablet and tablet holder of the feed screw, the gearing, the reproducer carrier, and the brush substantially as described.

Eighty-sixth. A reproducer having a flexible or flexibly mounted style, movable sidewise independently of the diaphragm or device to which the style communicates vibration substantially as described. 15

Eighty-seventh. *Ninth.* A reproducer having the style attached to or in one piece with a comparatively broad and thin strip, placed on edge, said style in consequence of the flexibility of said strip being movable sidewise independently of the diaphragm or device to which the style communicates vibration, but in consequence of the breadth of said strip being practically rigid to pressure in other directions, substantially as described. 20

Eighty-eighth. The combination with the reproducer style and diaphragm or device to which said style is to communicate vibrations, of a comparatively broad and thin strip placed on edge and attached to or in one piece with said style said strip being hinged to the frame so that the style may be vibrated in the plane of said strip substantially as described. 25

Eighty-ninth. In a reproducer the style attached to a thin metal strip breadthwise of the same, like a hammer head substantially as described.

Ninetieth. The reproducer style attached to, or in one piece with a broad and thin strip in combination with a diaphragm or device upon which the reproduced sonorous vibrations are to be impressed, and a spring carrying said style and strip and serving as a hinge to permit them to vibrate substantially as described. 30

Ninety-first. The combination with the reproducer style and the diaphragm or device upon which the reproduced sonorous vibrations are to be impressed by said style of a flat metal spring interposed between the style and diaphragm and forming a yielding connection through which the reproduced vibrations are transmitted substantially as described. 35

Ninety-second. The combination with the reproducer style and the diaphragm or device upon which the reproduced vibrations are to be impressed by said style, of a metal spring or spring tongue whose normal vibration is quicker than that of said diaphragm and whose tension tends to move the style away from the diaphragm substantially as described. 40

Ninety-third. In combination with a diaphragm a frame having a concave seat for said diaphragm the walls of said seat converging to an opening in the back through which the sound may escape substantially as described. 45

Ninety-fourth. The combination with the diaphragm and the frame having a concave seat for said diaphragm of a spring for holding the diaphragm to its seat and for straining the same substantially as described.

Ninety-fifth. The combination with the diaphragm, its supporting frame, and the style of the spring for straining said diaphragm substantially as described. 50

Ninety-sixth. The combination with the diaphragm and its supporting frame, of the spring pressing inward on said diaphragm and the style carried by said spring substantially as described.

Ninety-seventh. The combination with the diaphragm and its frame, of the spring projecting over said diaphragm, the block between the spring and diaphragm and the style bearing upon the spring beyond said block substantially as described. 55

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Ninety-eighth. The combination with the reproducer style of the hard rubber diaphragm and the frame for supporting said diaphragm at the edges substantially as described.

5 Ninety-ninth. The combination with a diaphragm and its frame, of a spring projecting over said diaphragm, a style carried by said spring, and a block between the diaphragm and spring, adjustable lengthwise of the latter, substantially as described.

One hundredth. The combination with the reproducer of the guard fastened over the face of the same, substantially as described.

10 One hundred and first. The reproducer provided with a guard fastened over the face of the same, and curved to form horns upon which the reproducer may rest, substantially as described.

One hundred and second. The double ear piece comprising the elastic and flexible hollow branches provided each with a cup connected with the branch by a ball and socket joint substantially as described.

15 One hundred and third. The combination with the reproducer and the carrier therefor, and the feed screw for moving them, of a sound conveying tube on the machine frame, and a flexible sound conveyor between the reproducer and the said tube, substantially as described.

20 One hundred and fourth. The combination with the reproducer, of the double ear piece comprising the elastic and flexible hollow branches and the cups jointed to the ends of said branches, substantially as described.

One hundred and fifth. The combination with the feed screw and the reproducer carrier supported and capable of turning on said screw, of the reproducer hinged to said carrier, and a stop for lifting the reproducer when the carrier is turned in the proper direction, substantially as described.

25 One hundred and sixth. The combination with the feed screw and the reproducer carrier engaging and capable of turning on said screw, and provided with an extension or tail, of a movable bar under said tail for upholding the same, so that by depressing said bar the carrier can be turned and lift the reproducer from the tablet substantially as described.

One hundred and seventh. The combination of the feed screw the reproducer carrier mounted thereon and provided with an extension or tail and the bar under said tail for upholding the same, substantially as described.

35 One hundred and eighth. The combination with the reproducer carrier, of the reproducer mounted on a standard hinged to said carrier, said standard being provided with a thumb piece or device whereby the reproducer can be held up in placing the reproducer on and removing it from the machine, substantially as described.

40 One hundred and ninth. Tenth. The combination with the tablet, tablet holder, feed screw, gearing, reproducer and reproducer carrier, of the mechanism for controlling the rotation of said feed screw, the same being connected with said carrier so as to lift the reproducer from the tablet, when operated to stop or to reverse the rotation of said screw substantially as described.

45 One hundred and tenth. The combination with the tablet holder and the feed screw of the gearing for rotating the feed screw in the forward direction, the hinged frame for disengaging said gearing when moved a certain distance, and additional wheels connected with said frame so as by a further movement to engage said wheels and reverse the rotation of said screw substantially as described.

50 One hundred and eleventh. The combination with the tablet holder the feed screw, the gearing for rotating the same in a forward direction, the gearing for rotating the same backwards at a greater speed, and mechanism for bringing the latter into action, substantially as described.

55 One hundred and twelfth. The combination with the reproducer and a conveying tube for the reproduced sounds, of a stop cock in said tube for moderating at will the loudness of the sound to be conveyed to the ear, substantially as described.

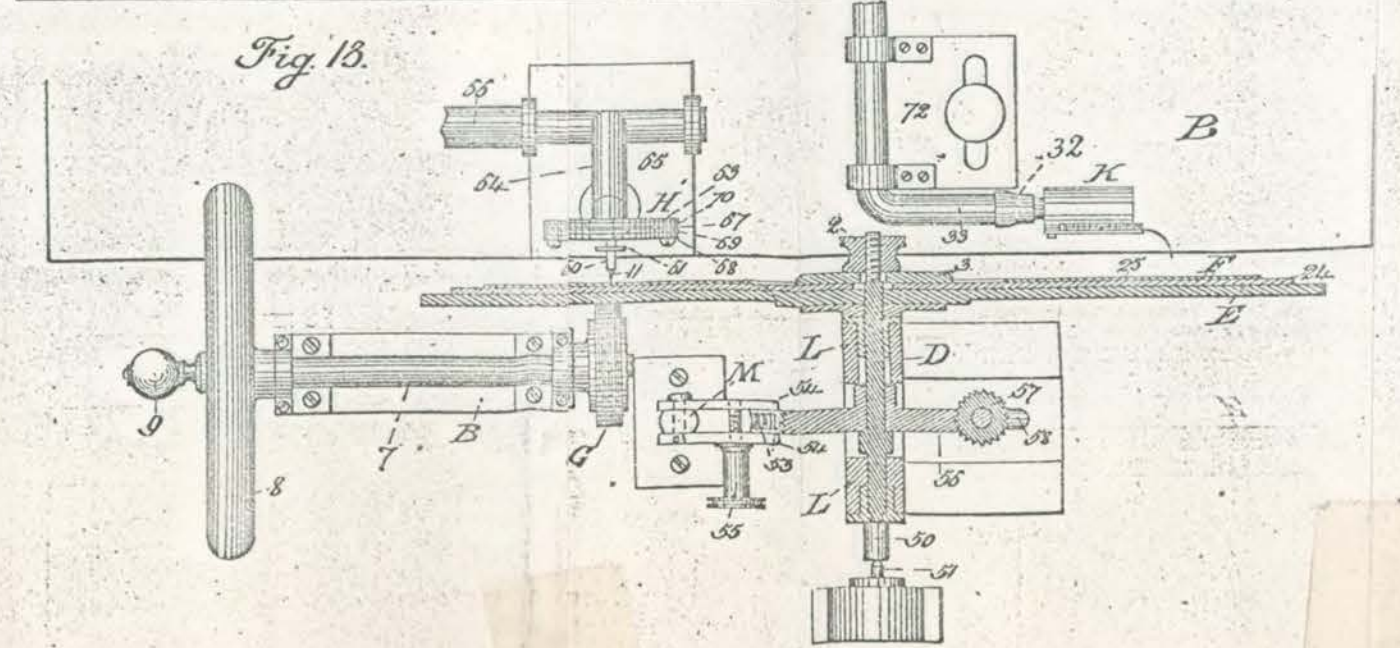
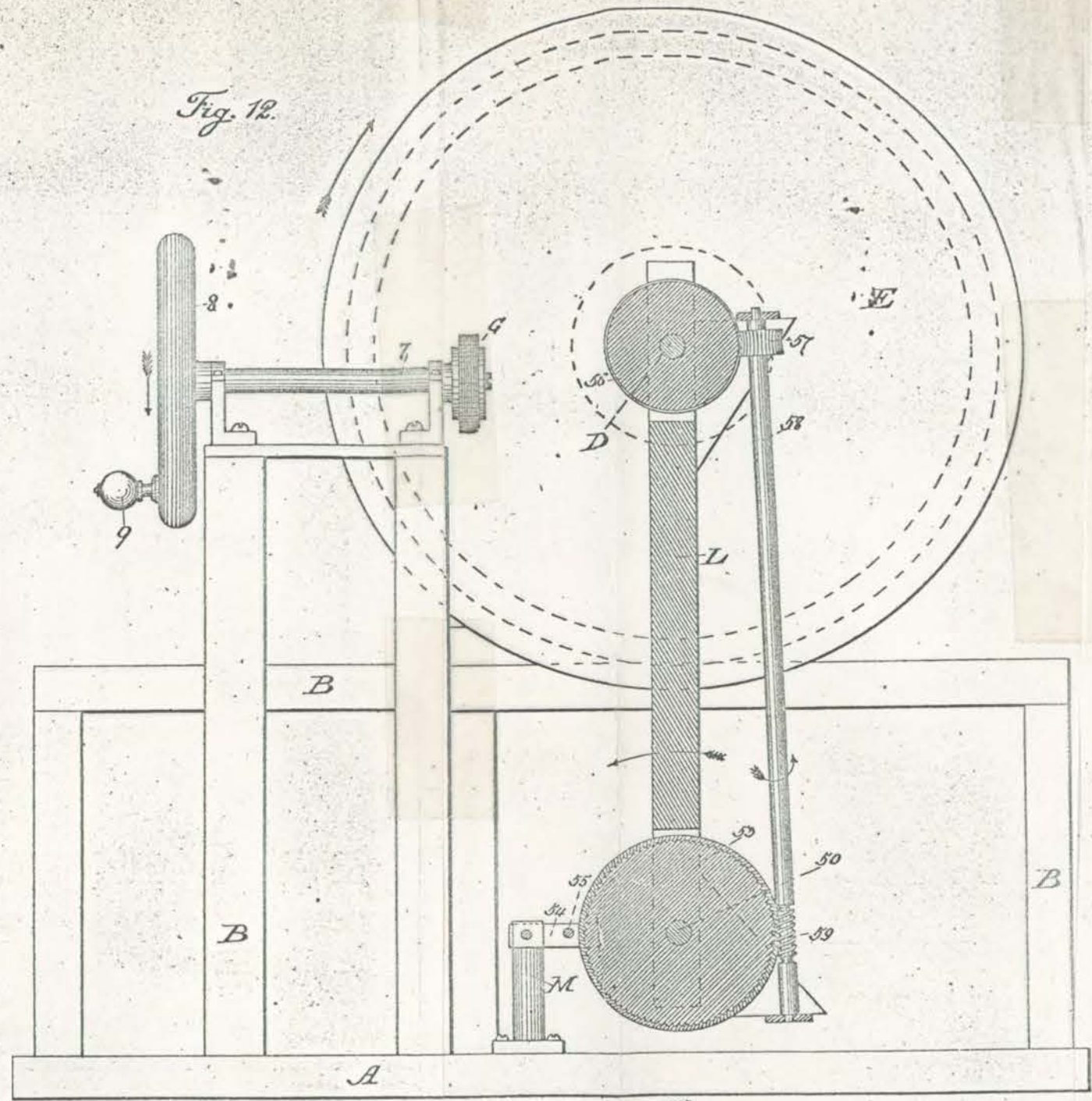
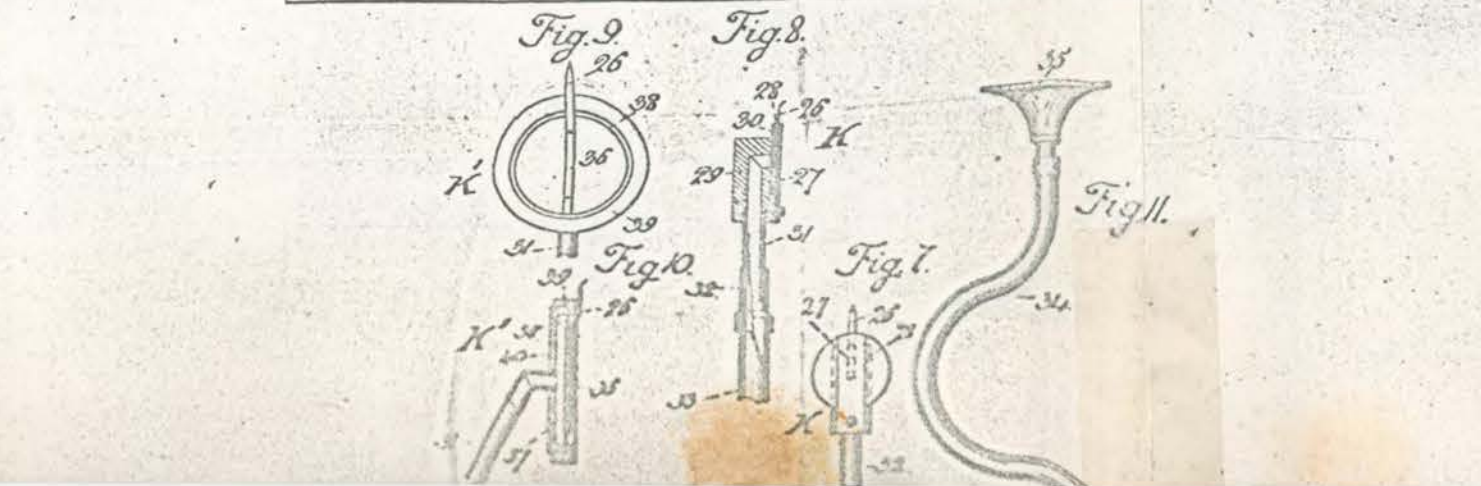
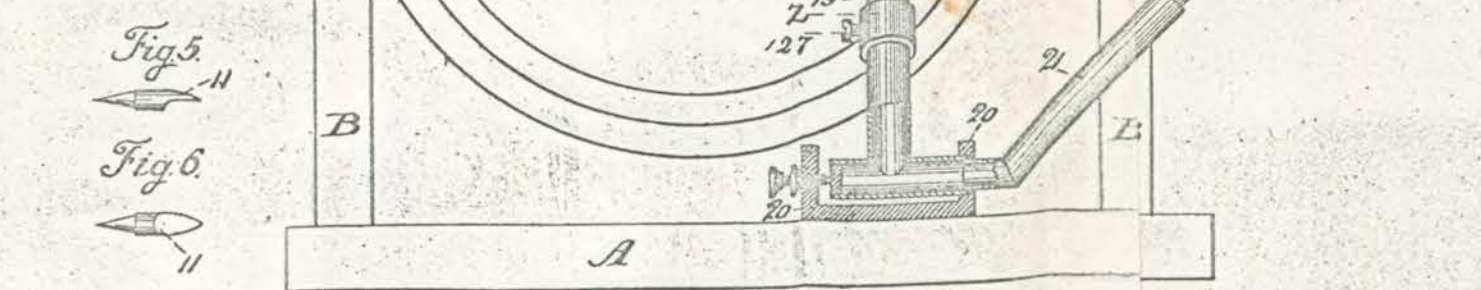
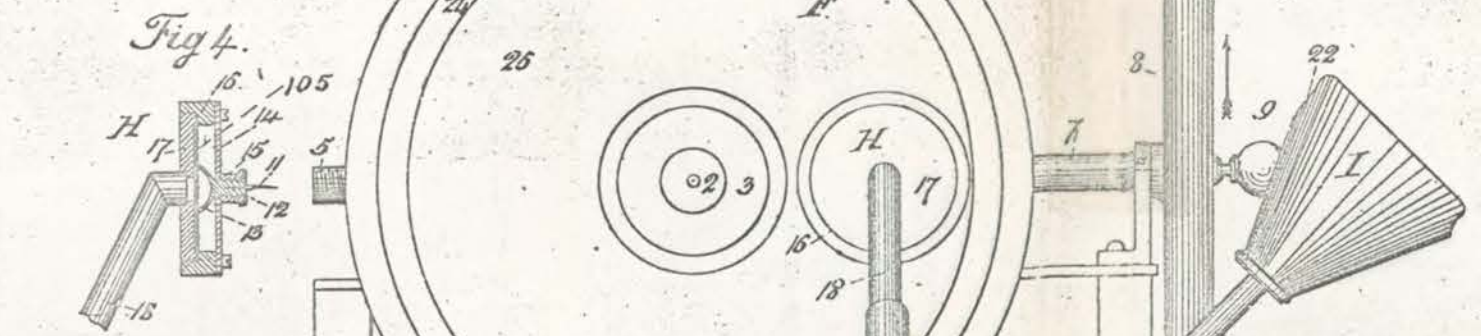
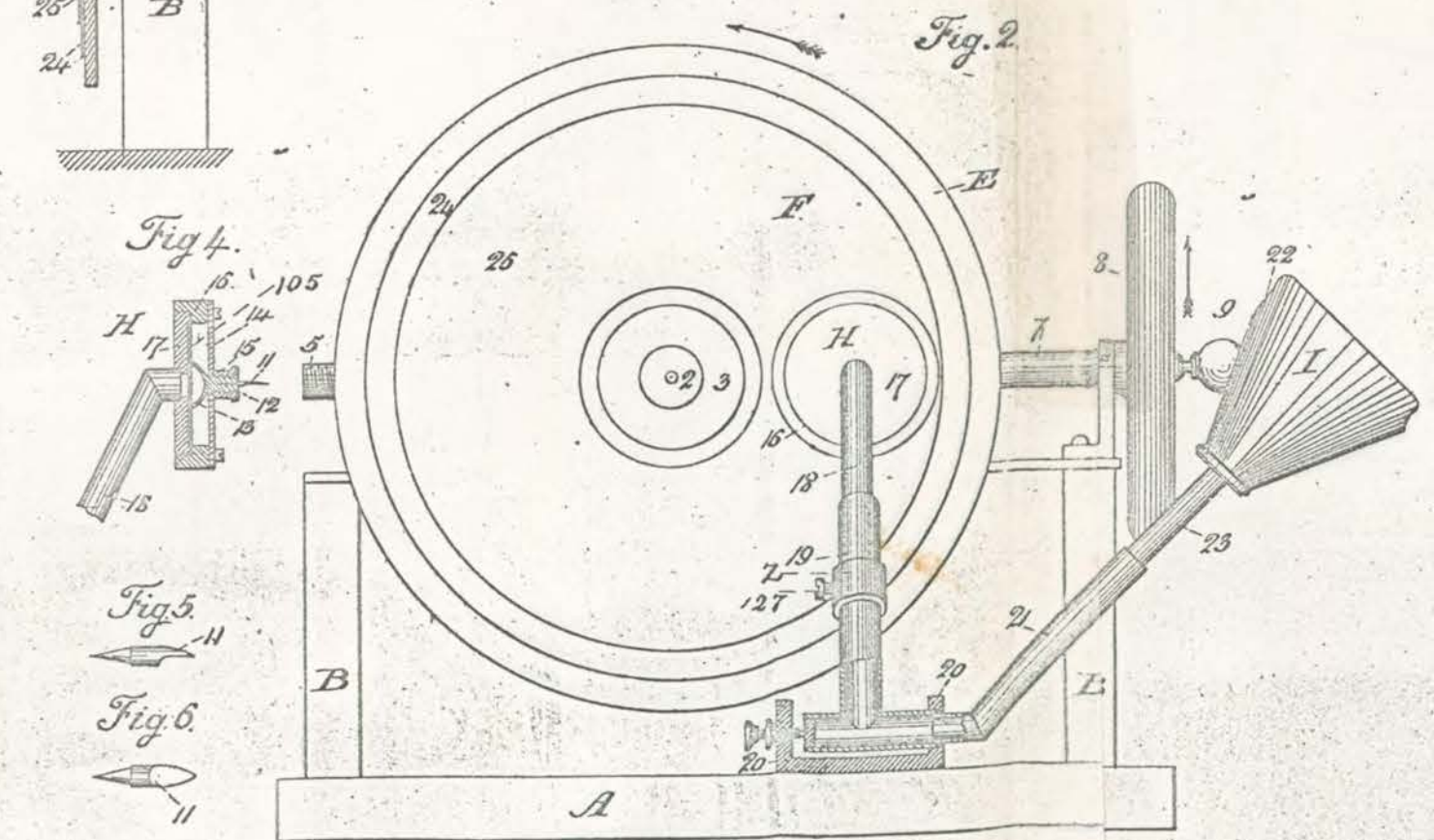
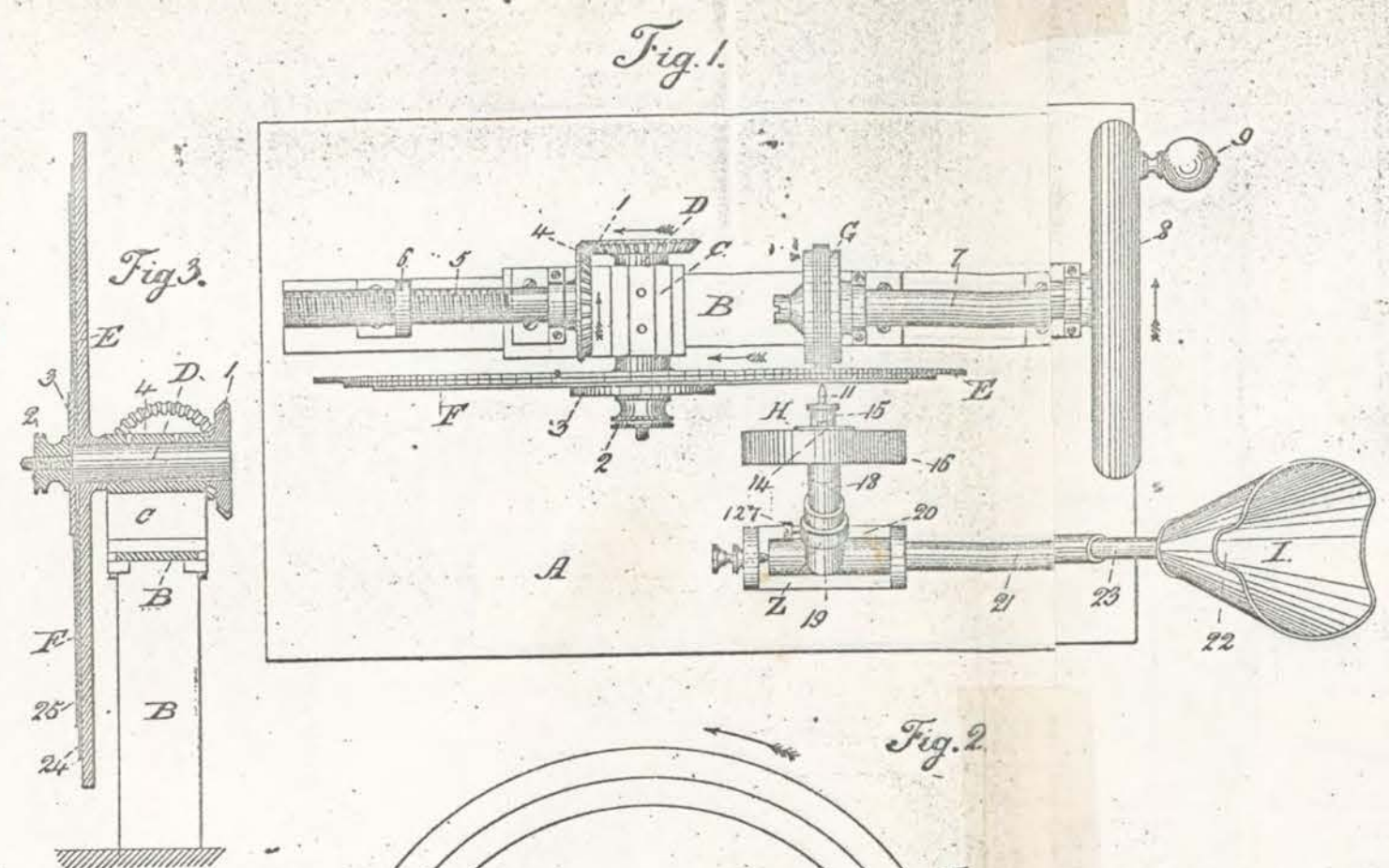
Johnson's Impts. in and Apparatus for Recording and Reproducing Speech, &c.

~~One hundred, and thirteenth. The improved recording and reproducing machine comprising the following elements, in combination; a hollow cylindrical self-sustaining tablet, a tablet holder journaled and hinged at one end to the machine frame, and journaled and detachably connected with said frame at the other, a feed screw, gearing for rotating the said screw in either direction according to the wheels engaged; a hinged frame for controlling the rotation of said screw, and the recording and reproducing instruments with their carriers substantially as described.~~ 5

Dated this 4th day of May 1886.

J. HENRY JOHNSON, 10
Agent.

Redhill: Printed for His Majesty's Stationery Office, by Malcomson & Co., Ltd.
[G. 6048-125-8/1901.]



[This Drawing is a full-size reproduction of the Original.]

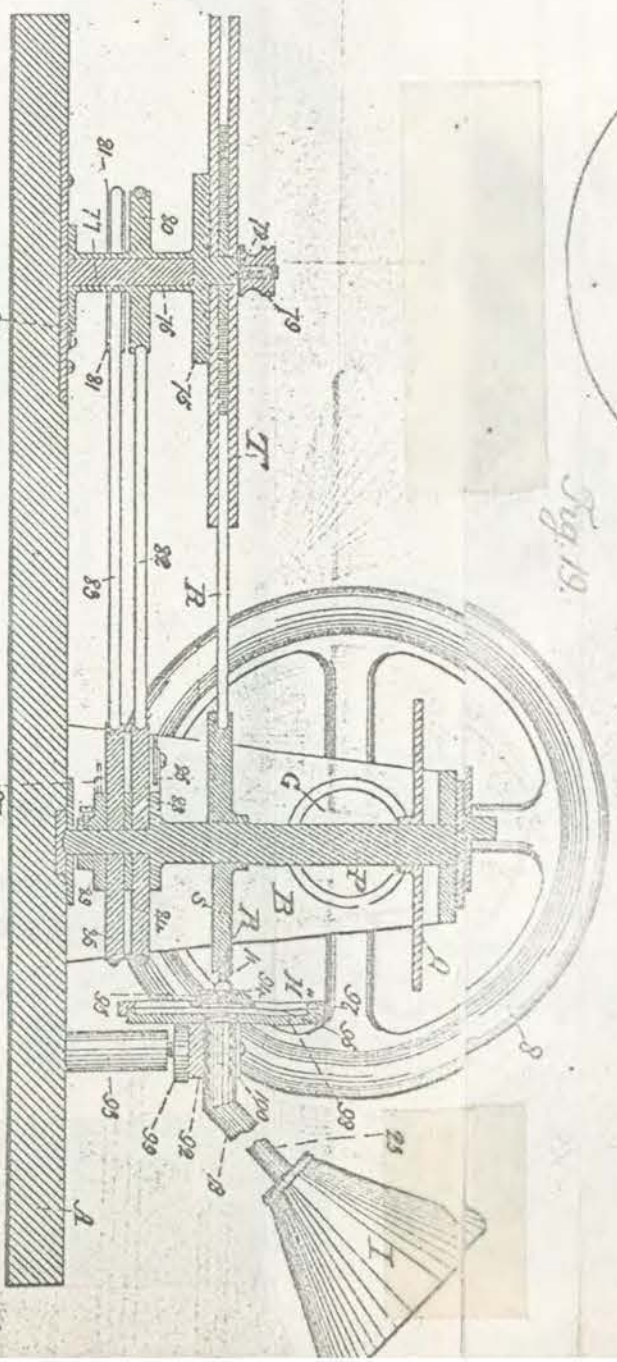
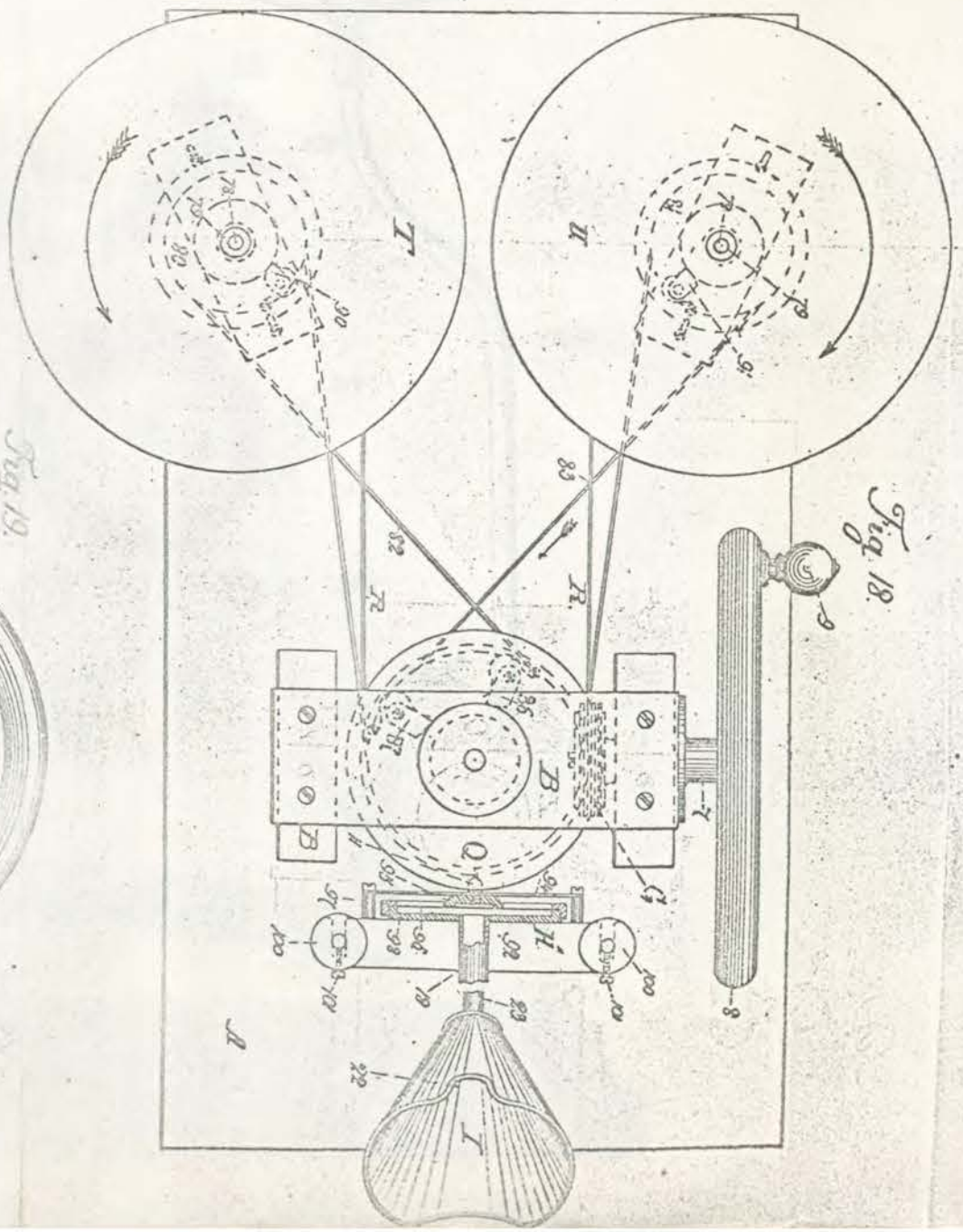
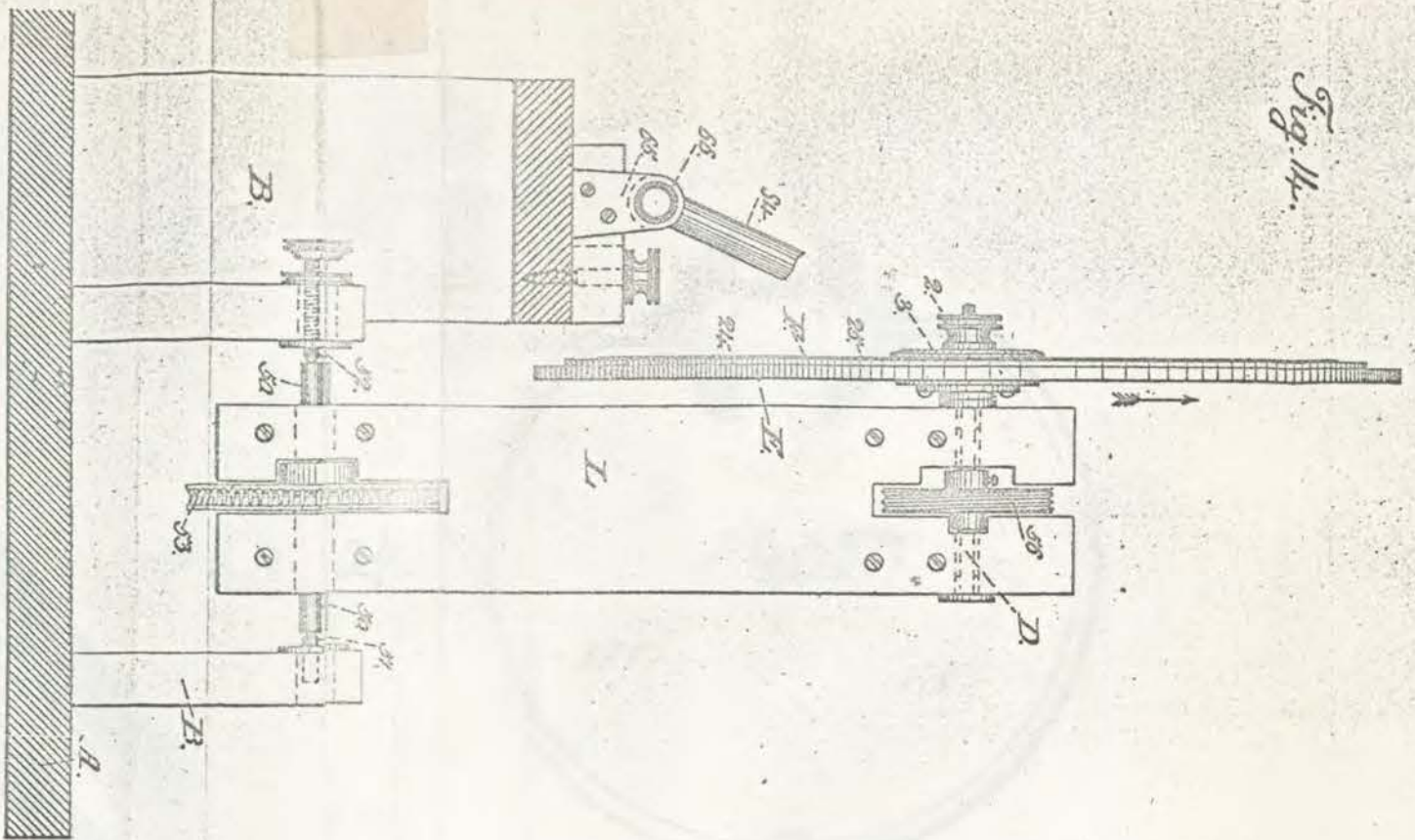


Fig. 38.

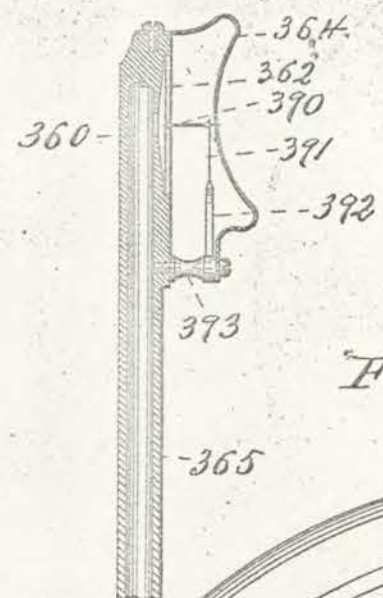


Fig. 39.

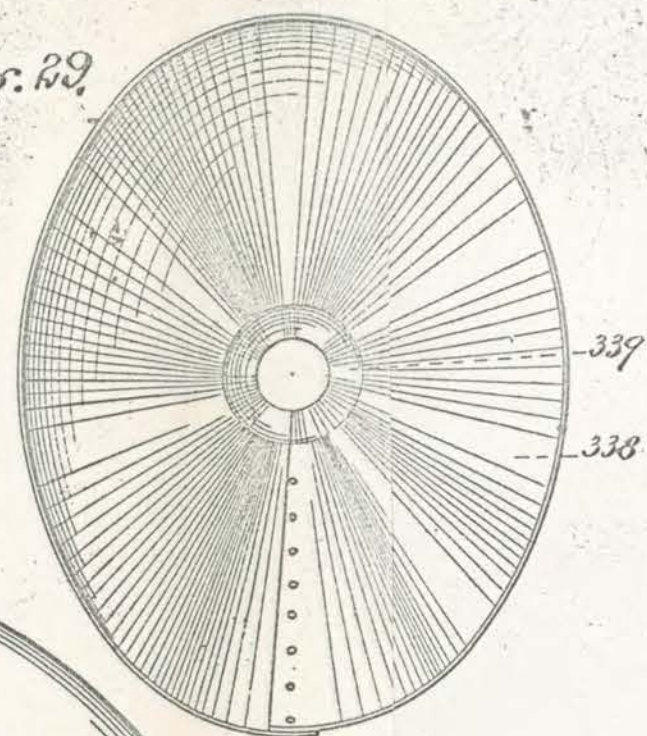


Fig. 23.

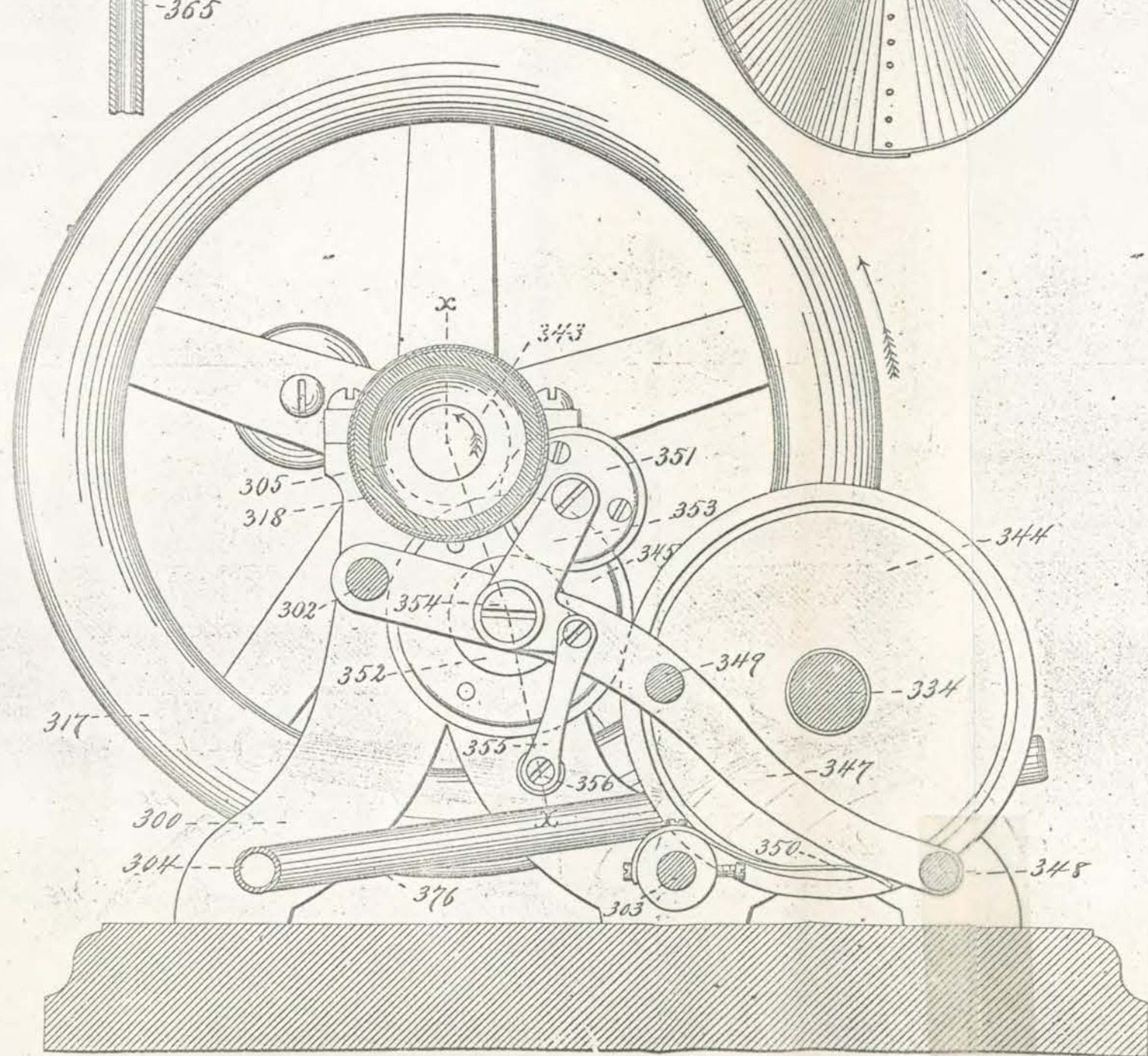


Fig. 24.

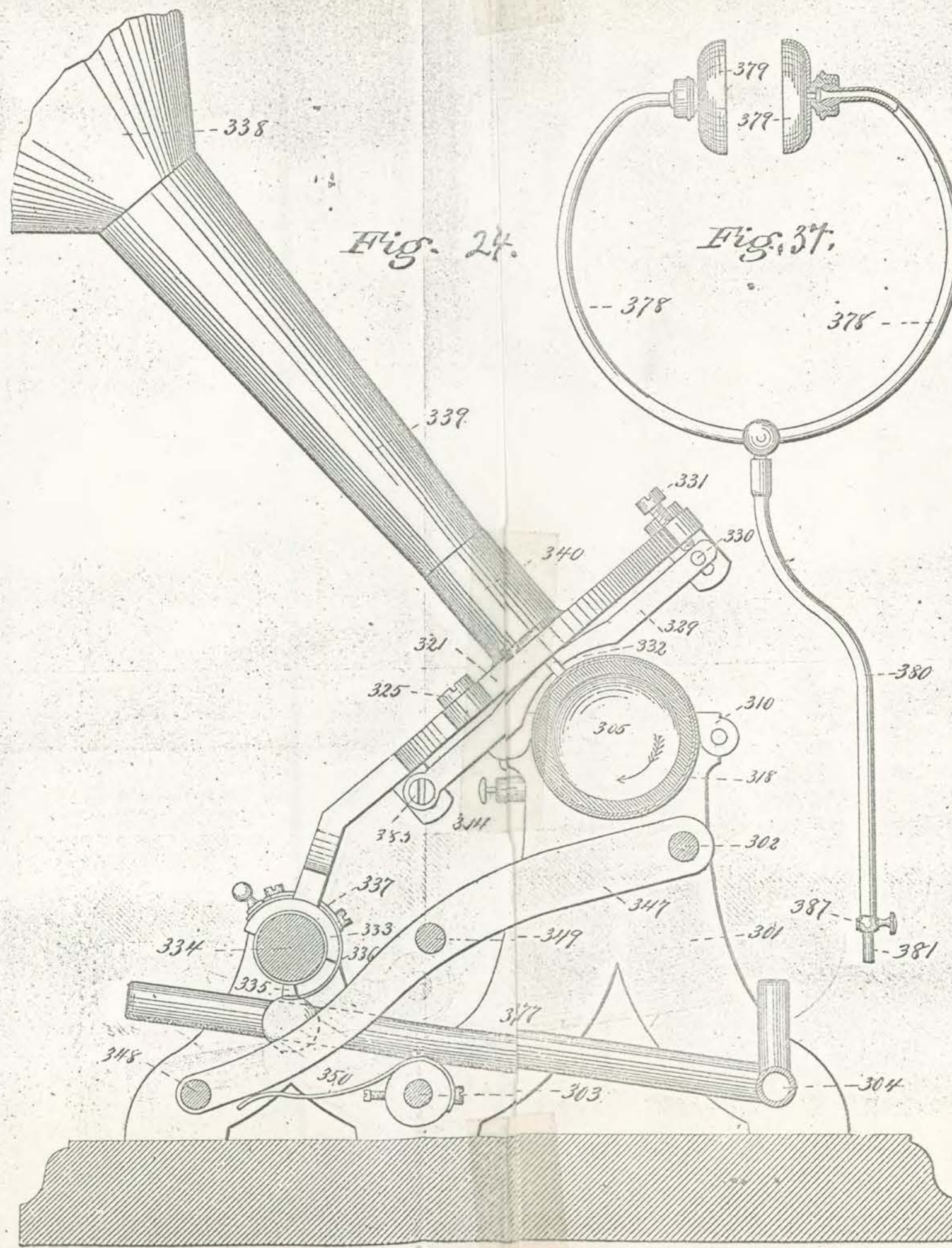
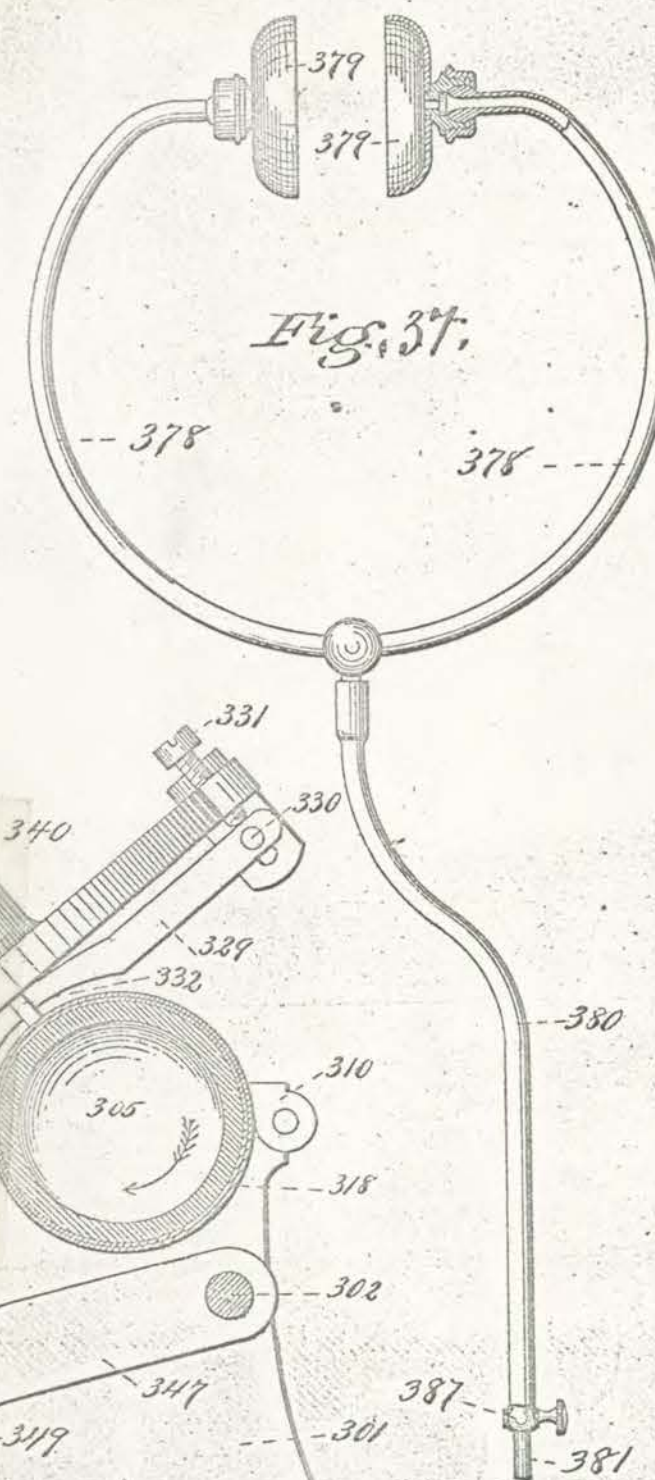


Fig. 37.



[This Drawing is a full-size reproduction of the Original.]

Translation of Cros French Patent.

COPY OF THE PATENT OF INVENTION
FOR 15 YEARS

TAKEN OUT THE 1ST OF MAY, 1878,

FOR

"NEW METHODS IN PHONOGRAPHY,"

BY

CHARLES CROS,

And which was delivered to him the 27th of July, 1878, under No.
124,213.

I formulated the principle of phonography and described its realization in a note, sent under sealed cover to the Academy of Sciences of Paris, on the 30th of April, 1877.

The cover was opened in the sitting of the 3d of December, 1877, and the note contained therein was inserted in the "Comptes Rendus," copy of the same sitting.

Previous to the opening and publication of this paper, I had Mr. Leblanc (the Abbé Lenoir) publish an article he set up, in which the phonograph is described more in detail. This article is in the number for the 10th of October, 1877, of the "Semaine du Clergé," a journal published at Paris.

Later, during December, 1877, and in the beginning of January, 1878, "Le Rappel" published a series of articles on the same subject and according to my indications. I inscribe here all the thanks I owe Mr. Victor Meunier for his bright articles.

Other papers have occupied themselves at the same period with the same question, always in my name.

The name of *phonograph* had then been changed to *paleophone*. The future will decide as to the best of the two names.

Mr. Thomas A. Edison, of New Jersey (United States of America), occupied himself with the same problem. He took out a patent at Paris the 19th of December, 1877. In this patent, amongst other ideas more or less distant from the present subject, there is question of several theoretical projects and methods of registering and reproducing sounds. It is only in a certificate of addition to the said patent,

under date of the 15th of January, 1878 (current year), that the phonograph is described, the presentation of which to the French public made such an impression.

This phonograph, except its special construction, and especially the use of tinfoil, is in accordance with the description and formulas which I published or had published in 1877 under the dates of October 10th, December 3d and following.

The patent of Mr. Edison is therefore ineffective with regard to what I have previously published; notably the use of an index closely connected with a vibrating disk, an index cutting its movements on a cylinder having a double, rotary and progressive movement, in a manner to obtain a helicoidal tracing.

There remains as the exclusive property of Mr. Edison, the helicoidal grooving of the cylinder, the tinfoil receiving the tracings and reproducing the vibrations, the special construction of the disk.

Outside of these particular parts, everybody can construct phonographs of any system, since I have put the phonograph registering on a flat spiral or cylindrical helix into the public domain. I have further published divers special methods which may be freely utilized in practice.

As the phonograph has greatly gained the favor of the public, and as it is just that I should profit thereby, I reserve the exploitations of the following methods applicable to the same, which I have invented.

The question is of registering, by a continuous tracing, the vibrations of a drum.

I see three kinds of tracings: the transversely undulated tracing, the tracing undulated in depth, the simple lineal tracing, straight or rectilinear which I will call the straight tracing. I realize this latter so as not to further mention it, by causing a surface containing a salt which can be decomposed by the electric current (silver salt, for instance, on a surface similar to that given by dry resin) to pass below a conducting point put into connection with a more or less conductive body according to the greater or lesser pressures it is subjected to by the vibrating membrane. Graphite in crayons or in a series of disks, water rendered conductive by suitable salts or acids, etc., are and have been employed in the telephone with a battery current. Any similar arrangement applicable to the telephone is suitable.

It is seen that the current separates a quantity of silver proportionate to its variable intensity. If, then, the surface is made to repass, after being fixed (development and washing in hyposulphite, for instance), below the point which closes a galvanic circuit in which a telephone is interposed, this telephone will be made to speak back.

The tracing undulated in depth is that which Mr. Edison adopted, after having abandoned diverse projects based on the straight tracing. This tracing requires a notable force of the stylus on a yielding substance. Tinfoil gave the first results. Despite the reducing advantage of the immediate repetition, despite the facility and the simplicity of its use, I do not believe in the future of tinfoil in phonography. However, tinfoil has been proposed and used with success for the first time by Mr. Edison.

It will be seen further on that I obtain the immediate repetition by another process which gives, moreover, the facility of indefinite repetition.

The transversely undulated tracing is that which I proposed first. Obtained by lampblack deposited on the surface of glass or smooth paper, it is that which requires the least force of the tracing stylus. Consequently it will give more details, more fineness in the results, since it opposes the slightest resistance to the small vibrations which are also the weakest ones. It is this process which will give, in my opinion, serious and complete results. I will describe it, specially keeping to the practical details which I have discovered since my note of April 30th, 1877.

If the tracing was obtained in a spiral on a flat glass, a hot solution of bichromated gelatine is softly poured on the glass, in a manner as not to disturb the layer of lampblack. This is allowed to coagulate, dry, or it is immediately dried in a drying chamber on a leveled tripod.

Then it is exposed to the light by the back. It is then washed in warm water. The raised tracing in the state of an undulating line adhering to the glass, which line is formed by the non-dissolvable gelatine, on account of the bichromate, by the light passing there, where the stylus eliminated the lampblack.

This plate itself can be used for the repetition, when placed on the turning-plate. A small strip of cardboard, or of another resisting substance, is so arranged that it rubs the projecting sinuous line of the tracing. The sounds are thus reproduced by a mechanism similar to that known in physics as the *toothed wheels of Savart*.

By simple or double casting, the sunken or raised plate is obtained in metal. The sunken plate is suitable for repetition by means of a mouthpiece. This is how: a small tube ending in a narrow slot is in connection with a blowing device, in a manner that a thin sheet of air escapes therefrom. This tube is kept opposite and at a slight distance from the sunken plate. The surface is caused to turn and the air strikes the depressions with a noise so much the greater as they have a greater transverse amplitude and wish as many interruptions as they have returns within a given limit.

From this thus results the repetition of the sounds in their two vibrating characteristics, amplitude and frequency.

The solid strips in the mouthpiece can be put into solid connection with the membranes of the cornets or engrossing means.

The lampblack can be replaced by a body insulating an underlying metallic plate from the engraving action of an acid. In this case the work of the stylus is increased by the cohesion of the insulating substance. Tallow, paraffine, the varnish of aqua fortis can serve.

In this case an indentation is obtained which is only good for the repetition with a mouthpiece, or with a solid joint entering into the indentation and causing a sonorous body to vibrate.

In all the methods above described the flat spiral tracing or the helicoidal cylindrical tracing can be used.

The first is convenient for the engraving or other transformation of the tracings by the action of the light. It permits, moreover, of the use of glass, the smooth surface of which (such as it is or ground), remains silent under the friction of a plate or under the blowing-in of air; whilst the tracing, in relief or roughly cut out, easily produces elementary noises.

The inconvenience of this tracing is in the loss of surface towards the center of rotation where the arcs of the spiral become too short for the medium rate of speed.

The helicoidal cylindrical tracing is preferable from this latter point of view, since the entire surface of the cylinder is utilized. But the glass must then be replaced by paper blackened by a flame, or by the metallic surface coated with an insulating substance. These surfaces are less smooth than the glass, and the insulating substance decreases the liberty of the stylus by its cohesion.

With the blackened paper I employ the following means to obtain the engraving:

I begin by coating the cylinder, or rather the polished metal tube covering this cylinder, with bitumen of Judea. The bitumen of Judea dissolved in benzine is put into a receptacle into which the cylinder carried by a horizontal shaft is submerged. The cylinder is turned rapidly and withdrawn, always turning it. With practice a sufficiently exact coating is obtained. The operation must be done under a yellow non-actinic light.

Then a thin and translucent sheet of paper is taken, which is dampened on one side and is applied on this side to a looking-glass or to a plain-glass. The paper thus adhering is then passed up and down over a smoky flame, verifying, by the transparency, whether the blackening is sensibly equal.

A white margin was left, by means of a strip of paper, pasted by water to one of the borders of the large sheet, cut to go around the

cylinder plus this margin. The blackened sheet is taken off; it is applied when damp to the cylinder, the white margin first. A strip of gum is put on this margin by a brush and the other end of the sheet is applied thereto, trying to stretch it. This is allowed to dry in the laboratory with the non-actinic light. The paper retracts and exactly covers the cylinder.

Once the tracing obtained by this paper, the cylinder is exposed to the light, to the sun, turning it with a regular movement. At the end of the time of exposure, determined by previous experiments, the paper is taken off; it is washed in ether. The tracing is then reproduced by a line of insoluble bitume. The empty metal is coated; the bitume is taken off by a suitable dissolving action (liquid ammonia for instance) and the engraving is done by an acid.

Here, now, is a very different method from those which have just been described. The entire future of phonography lies, in my opinion, in the use of this process, at least as far as the repetition of the sonorous phenomena is concerned.

The registering will be direct or indirect according as to what experience will decide and as to what the degree of precision will require. This registering is done on a continuous metallic wire, either a steel wire, a piano string of indefinite length rolled on a loose bobbin. Two small laminating cylinders press this wire and draw it, unwinding it from its spool; these cylinders are actuated by the regular power of a clock movement or simply by hand to control their gearing.

A suitably long portion of the part of the wire running between the spool and the traction roller, is pressed at its two ends by two roller conductors, rotating freely, of copper connecting with the poles of a strong battery. This portion becomes heated, reddens, can even thus be heated to white heat. It slides on an agate, or another stone refractory to the heat developed. The stone has a guiding groove in which is dug a small hole. Opposite to this small hole is the stylus solidly connected with the vibrating drum. This stylus is a sharp splinter of quartz or of another stone, a splinter mounted on springs and bearing by the intermediary of a bearing against the vibrating drum. A screen, perforated to allow this point to pass, protects the drum against being heated, which might be produced by the reddened steel wire.

The talking, singing, &c., is done against the drum, and the point, which is solidly connected therewith, imprints the more or less intense vibrations on this wire, which can be softened, by the action of the current, until close to the melting point. Directly behind is arranged a grooved wheel carrying a liquid which cools off the wire and definitely solidifies the impressions. The more or less intense vibrations are thus represented by depressions or curves more or less accentuated in the hardened steel wire.

The repetition can be immediately obtained by causing the wire to pass over the same road, the action of the battery being suppressed. For this repetition the quartz point will be replaced by a metallic point which does not affect the steel.

Such is the direct registering. If the work of the cutting point on the heated metal is too great to give the required details and fineness, the indirect registering will be employed.

A tracing, obtained on lampblack, and cut flat, spirally or helicoidal cylindrically, is taken. The tracing is an indented one, a point runs along the undulating road, which point is solidly connected with a lever which can bear with its other end on the wire resting on the agate with the groove, of which I have spoken, and opposite the small hole. The wire is heated, either by a battery or simply by a gas blower. The wire is drawn along at a speed adequate to the speed of rotation of the engraved surface.

The lever doing its work, every undulation of the engraved line is reproduced in a corresponding flattening and bending in the steel wire, which, cooled off as already said, retains these traces definitely.

The repetition is effected like for the direct registering. This repetition can, moreover, be made in a continuous manner, although the tracings are from another time or different registering apparatus. This permits of always having several phonographs ready to operate and to act as relays to each other in case of long sound periods to be registered.

The registering on a continuous wire is entirely in conformity with the purposes of phonography—to fix the sound phenomena without breaking the thread of the discourse, however long it may be, the development of a spoken action, the continuance of a song, a symphony, &c.

The phonograms thus obtained are preferable in all points to those of the first methods described.

The phonograms in flat spiral have a useless central surface, therefore encumbering, and a quantity of unemployed metal. The helicoidal phonograms on a metallic cylindrical tube are not less encumbering and difficult to arrange for the repetition; they easily become false by crushing.

Only the thread-like phonograms have an absolute exactness, resistance to accidents; they require no arranging, no centering; they have an indefinite continuity; they will occupy the smallest possible space in the collections; there will be spools of wire; they will require the minimum of metal.

They will be the exact image of the time which passes whilst nature or man make a sound or sing.

There are still a few remarks for me to make on the construction of the drum.

In the thread telephones, the electromagnetic telephones, then in the phonograph of Mr. Edison, everybody has remarked that the voice takes on a special tone quality called quavering voice.

This effect is due to the sound proper of the receiving membrane; from this results a stop, a pedal as the harmonists say, similar to the continuous sounds produced by the profession of jugglers who use Punch and Judy talk, or also to the sounds of the lyre or bagpipe.

This peculiar sound can be attenuated by a very small dimension given the drum. The sound proper, thus becoming very high, is very weak. The thickening of the drum produces a similar effect. Thus the drum with a small surface and a relatively considerable thickness are those which are best suited.

Thus by combining the cavity of the drum and the size of the tympanum, as also its tension, in such a manner that the note reinforced by the cavity is different from the one reinforced by the tympanum, and also different from the harmonic qualities of this latter, this defect will be attenuated.

A drum with two membranes can also be employed, of suitable dimensions, realizing this difference.

I believe that the relation to be looked $\sqrt{\frac{2}{2}}$ for will be that from C to sharp, which in the modified scale is $\frac{\sqrt{2}}{2}$ that is to say, incommensurable. A cut of a hollow cone, quite thin, will be the casing of such a drum.

American Graphophone Co. vs. Berliner Gramophone Co., et als.
Defendant's Exhibit No. 14, Certificate of Addition to
Gros Patent No. 124,213, taken August 3, 1878, translated.
Samuel Bell,
Special Examiner

Copy of the Certificate of Addition , taken Aug. 3, 1878,
attached to the patent for invention for fifteen
years No. 124,213, taken May 1, 1878, by Mr.
Charles Cross, Engineer

9 Rue Christine, Paris.

Here is another method of registering the sound movements on a round or flat wire. This method has the advantage of directly giving solid tracings, fit for everlasting repetition, without the aid of either heat, light or electricity. It is, in one word, purely mechanical.

Against a polished disk rotating very fast, is applied a cloth ribbon, covered with rubber and coated with resin. This ribbon is held at one of its ends by a spring; its other end controls a spring-lever, carrying a point or tracing knife, below which the metal wire passes, whether round or flat, and on which the vibration lines are to be inscribed.

Before the ribbon there is a receiving diaphragm. A small, solid piece transmitting the vibration movements, carried by a spring, comes into contact with the center of the diaphragm on one hand and with the ribbon on the other.

This system of ribbon, stretched on its springs, and of the diaphragm provided with the solid transmitting piece can be approached to or separated

Cross--Certificate of Addition -- Page 2

from the rotating disk by a suitable regulating device. The detailed arrangement will be given in another certificate of addition, with the total drawing of the apparatus.

The said system is thus brought against the ribbon, so as to lightly pass the ribbon against the rotating disk. The pressure is, however, not strong enough for the friction of the disk to sensibly draw the ribbon.

This done, and if the diaphragm is spoken against, every vibration will determine, by means of the solid transmitting part, an increase in pressure, and thus friction. The disk will draw the ribbon, and this will lower the spring carrying the point or tracing-knife.

This knife will thus cut the round or flat wire with a force proportional to the vibration produced, multiplied by a constant factor, depending on the force of the rotating disk.

It is seen this arrangement no longer employs the force of the vibrations to obtain the traces, but it uses this force to employ the stronger power taken from an independent motor. It is thus the motor which works; and the sound-vibrations only serve to direct the work.

It would be possible, if necessary, to duplicate, triplicate, etc., the system; that is to say, to control by a first ribbon a spring which presses a second ribbon, etc. In this manner it will be possible, with a very slight power to control as great a power as may be desired.

The application of this system, the property of which I assume myself by this certificate of addition, are innumerable. In another addition of my

patent I will describe the apparatus constructed in detail.

It remains for me to add that the phonograph thus constructed is a megaphone -- that is to say, a sound-increasing apparatus. It suffices to attach the floating ribbon to the center of a diaphragm, so that the sound which actuate the receiving diaphragm are repeated with an intensity proportional to the force of the rotating disk.

Finally, if the solid transmitting part, which presses the ribbon, is operated by the traces on the metal wire, this ribbon being fastened to the center of a receiving diaphragm, the repetition will be made with an intensity which can be definitely increased by increasing the resistance of the diaphragm (steel plate, for instance) and the power of the motor.

Translation of Comptes Rendus Article on Cros
Phonograph.

COMPTES RENDUS,
OF THE ACADEMY OF SCIENCES.

December, 1877.

p. 1082-1083.

Translation.

Mr. Ch. Cros asked for the opening of a sealed paper, deposited by him April 30, 1877, and bearing title, "Process of registering and reproducing phenomena perceived by the hearing."

42 GRAPH

This paper, opened during the session by the permanent secretary, contains the following note:

In general my process consists in obtaining the tracing of the backward and forward movement of a vibrating membrane, and to make use of this tracing in order to reproduce the same backward and forward movement, with its intrinsic relations of duration and intensity, on the same membrane or on another suitable to render the sounds and noises which result from this series of movements.

It therefore deals with transforming an extremely delicate tracing such as that which is obtained by means of light fingers rubbing faces blackened at the flame, to transform, I say, these tracings into resisting tracings in relief or in grooves capable of conducting a movable part which will transmit its movements to the sonorous membrane.

A light finger is solid with the center of the face of a vibrating membrane; it ends in a point (a metallic wire, down of a quill, etc.), which rests upon a surface blackened at the flame. This surface forms part of a disk, which is animated by a double movement of rotation and rectilinear progression. If the membrane vibrates the spiral traced will be undulated, and its undulations will exactly represent all the backward and forward movements of the membrane, according to their duration and their intensities.

By means of photographic processes now well known, this undulating spiral, traced in transparence, is transferred in a line of like dimension, traced in grooves or in relief, on to a resisting material, tempered steel, for example.

This done, this resisting surface is placed in a motor apparatus, which causes it to turn and progress with a like quickness and movement to those which animated the registering surface. A metal point, if the tracing is in grooves (or a notched finger, if it is in relief), is held by a spring on this tracing, and at the other end the finger which supports this point is solid with the center of the face of the suitable membrane for producing the sounds. In these conditions, this membrane will be animated, no longer by the vibrating air, but by the tracing commanding the pointed finger, by impulses exactly alike in duration and intensities, to those to which the registering membrane was subjected.

The spiral tracing represents successive equal times by increasing or decreasing lengths. This will not be inconvenient if only the peripheral portion of the turning circle be utilized, the turns of the spiral being very close together, but then the central surface is lost.

At all events, the helical tracing on a cylinder is preferable, and I am now occupying myself in finding its practical realization.

U. S. C. O. E. D. of Pa.
American Graphophone Co. vs Berliner Gramophone Co., et als.
Depts' Ex. #16, Lehrbuch der Physik und Meteorologie by Muller
Pouillet Braunschweig Edition of A.D. 1868, Vol. 2, p.252,
Figures 253 and 254, translated.

- Treatise of Physics and Meteorologie

By Dr. Joh. Muller,

Seventh Edition

In Two Volumes-

Braunschweig, Friedrick Viewerg & Son.

A.D. 1868-

page 252.

Rheostat and Resistance Standard.

In order to be able to gradually change the resistance in the circuits of voltaic piles, Wheatstone, Jacobi, Poggendorff and others have constructed apparatuses which we shall call rheostats. Figures 253 and Fig. 254 show one of the most practical forms of rheostat which is substantially due to Wheatstone and in fact a rheostat for thick wire. On a roller of serpentine or marble a shallow screw-line is cut and a metal wire is wound therein having a diameter of $1/2$ to 1 millimeter (copper being used when small resistances are in question, German silver when large resistances are used) the end of the wire, at the right side of the cylinder penetrating its mass and being led and soldered to its metallic axis.

Against this screw-wire a brass roller r is pressed, which is provided with a groove corresponding to the thickness of the wire. It is slideable on the metal rod ab which is screwed at its opposite ends to strong

springs which press it against the serpentine cylinder,
as is plainly apparent from fig.254 which shows the
apparatus looked at from the side of the crank h..

It is clear,when the crank h is turned,that the
roller r,following the turns of the screw,will be shoved
along the rod ab,toward one side or the other,according
as the crank is turned toward the right or the left.

x x x x x x x x x x x

Fig. 253.

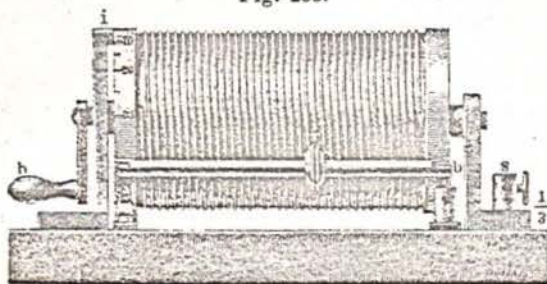


Fig. 254.



Poggendorff Annalen der Physik und Chemie.

Volume 59- Leipzig A.D. 1843 Plate 1, Figures 1, 2, 3.

XIV. Description of an improved Volta meter;

by M.H. Jacobi.

(From the Bulletin of the St. Petersburg Academy Vol. X No. 18).

In the sitting of September 3 of last year, I communicated to the Academy a description of several electromagnetic apparatuses and among them a regulator with a fixed resistance. Of this apparatus, which I herewith give the name of Voltagometer (from *αλφειν* to lead, conduct) and whose usefulness was proved through several measurements communicated at that time. I now transmit to the Academy a new drawing in accordance with an improvement made by Messrs Lenz and Nevander. Several disadvantages and inconveniences had become apparent with the old apparatus which are avoided by this new construction. In this instrument, of which Fig. 1, plate 1 is a plan, Fig. 2, a longitudinal elevation and fig. 3 a front view, the wire is wound on an accurately turned marble cylinder A B C D provided with shallow screw threads. One end of the wire is connected with the brass shaft of the cylinder, the other end with the cylinder itself. The shaft E F is prolonged on both sides * by a distance equal to the length of the cylinder. One

end has an accurately cut screw-thread corresponding with the thread of the cylinder, and travels on the bearing G which carries a split nut which can be drawn together through a screw a to prevent displacement.

These Annals Vol. 54, n. 340-

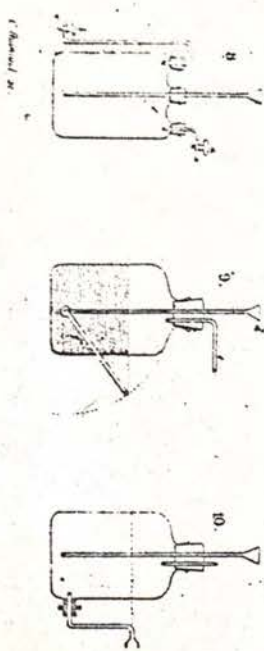
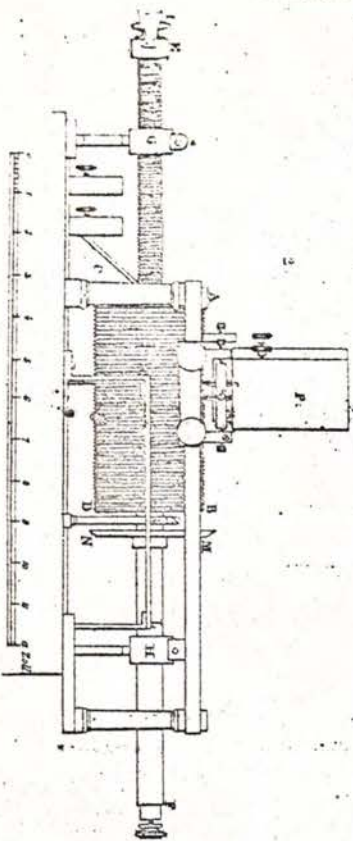
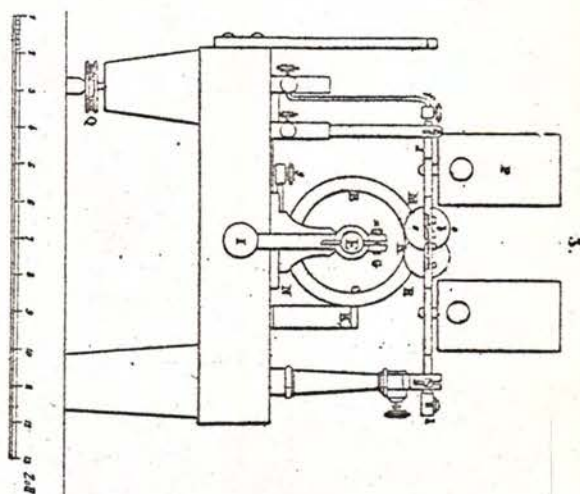
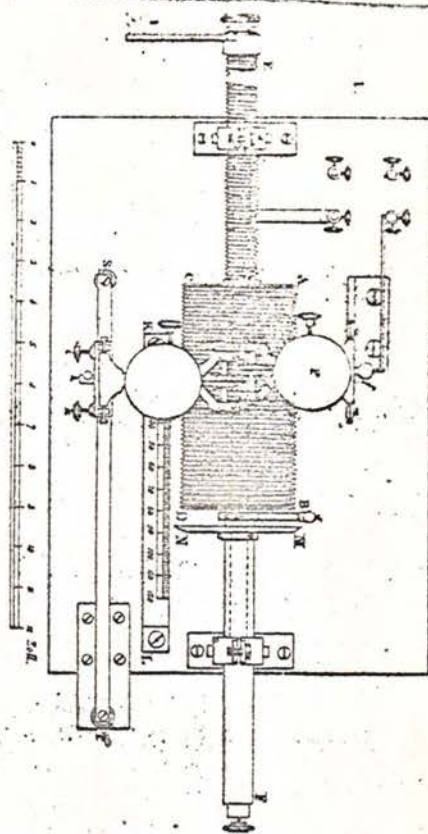
The other end of the shaft is turned down smooth and runs frictionally in the split and spring bearing H. On one end of the shaft, there is a crank I at the end of ~~the~~ which a long universally jointed rod may be applied so that the instrument may be directly operated by the observer at a distance. This is necessary in order to avoid every action of the spiral winding on the compass. K L is a scale placed parallel to the cylinder and marked to correspond to the threaded windings; M.N is a disk graduated to 100 parts, fastened on the shaft sharply beveled and placed tangentially to the scale in order to avoid all parallax. In this manner the disc, upon rotation of the shaft, runs along the scale so that $\frac{1}{100}$ of a winding can be read off, and $\frac{1}{1000}$ of the same can be readily estimated. The current is led to the roller o, which has a shallow groove and is loaded with a weight P. Its shaft runs in bearings bc of the lever d e, in whose forked ends the latter is secured, but in points which can be accurately adjusted. f is a screw clamp for securing the conducting wire. Another conducting wire can be secured to the screw clamp g which has a shoulder and runs in a slot in the base plate.

This screw clamp is secured to a brass rod which is provided with the two part collar h, which can be drawn together by means of screws and which embrace that part of the shaft which is found between the disk and the cylinder. It is to be understood that the current, which passes from the roller to the wire lying on one side of the same, goes to the shaft and is thence conducted away. By turning the cylinder this length of wire can be increased or diminished at pleasure and in this manner a changing current can be kept at a given intensity or a variable resistance be placed in the same. I have preferred not to secure the conducting wire to the clamp fastened to the collar but to connect it with one of the two bearings G H because it appeared to me that the contact between the collar and the shaft was not complete enough and might give rise to a source of error. The resistance of the shaft will in this case not remain constant but will change with the rotation of the cylinder but the error is very small since the shaft is of brass and is $7/8$ inches thick and quite short. Besides, in order to still further reduce this error, I have electrically connected both bearings with each other. The instrument is placed on a low table one of whose feet is provided with an adjusting screw Q.

The wire which is used in my instrument is of platinum about 30' long and 0".0219 (English) in diameter.

The roller is also made of platinum in order to avoid imperfect contact caused by oxidation; but there is the disadvantage that the platinum is too soft and is in danger of suffering from the roller loaded as it is with a heavy weight.

Although both ends of the wire are of exactly the same diameter and although the platinum is of the greatest purity, it yet appears that equal lengths of the same have unequal resistances and that the differences transcend, more or less, the limit of possible errors of observation. It will therefore be necessary, for very accurate observation to make up a scale of the relative values of the windings ~~xx~~ or if possible to express the conduction values by means of ~~xx~~ interpolation formulas. For this purpose Mr. Lenz has added a second auxiliary roller which stands opposite the first. In use the conducting wires are not connected to the shaft of the instrument, but with screw clamps f h which are connected with the rollers so that the current passes from the rollers merely through the wire lying between them. By turning the roll (cylinder?) constant pieces of the wire spirals can be measured at different points and be compared with each other. The forked bearing of the auxiliary roller can be moved along the brass piece S T and clamped in determinate positions by screws i k so that a greater or less number of turns can be brought between the two rollers.



18

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Telegraphic Journal Article on Carbonel
Phonograph.

THE TELEGRAPHIC JOURNAL, VOL. 7, P. 53, PUBLISHED AT
LONDON, FEB. 1, 1879.

THE PHONOGRAPH.—The Abbé Carbonel, of the Belsunce School, Marseilles, has been experimenting with the phonograph, and concludes that the recording and rehearsing diaphragms should be distinct, the former having a very sonorous plate operating on very stiff, hard foil, the latter a delicate membrane like that of the ear. The foil could be made from a copper band thinly coated with wax to take the impression, and corroded afterwards by acid so as to obtain a hard metal cast; but this is necessarily a defective process. The Abbé, therefore, employs albumen spread upon paper or other base, instead of the wax applied to the copper. The soft albumen record is afterward hardened in a well-known manner, and a hard matrix, whose dints vary in depth with the intensity of the sound, is obtained. As a means of reproducing the sounds he suggests the use of Savart's wheel instead of a vibrating plate.

19

"Engineering" Article on Lambrigot Phonograph.

ENGINEERING.

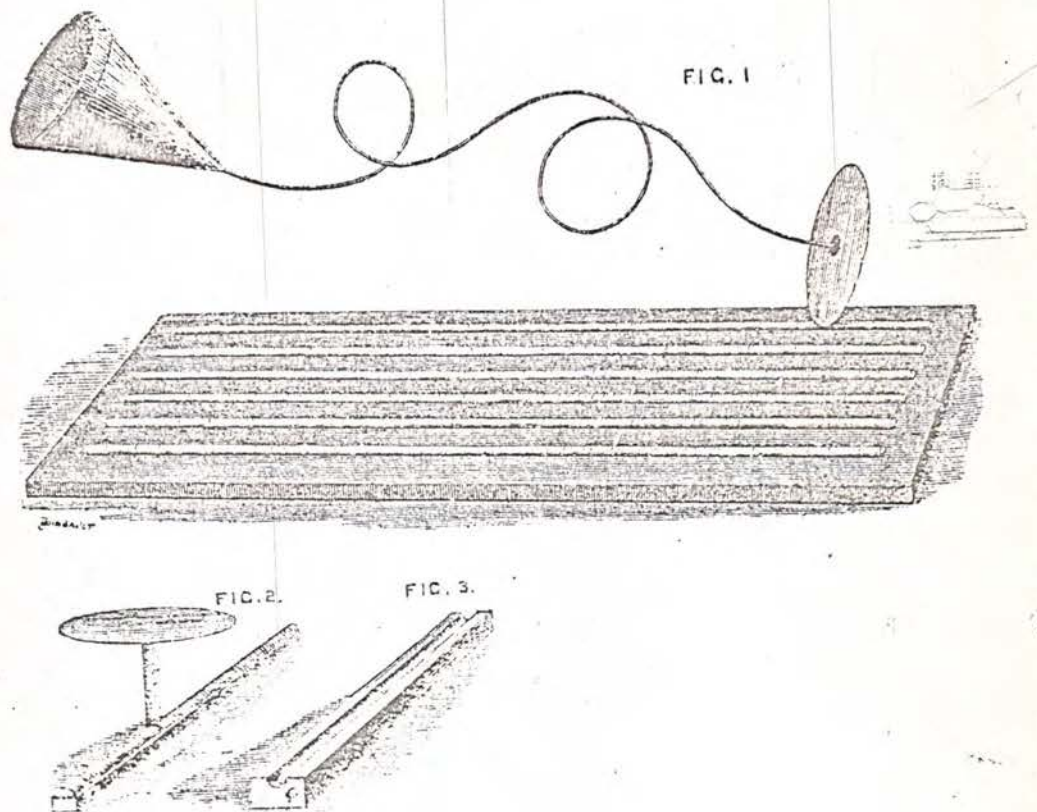
Vol. 27, p. 326. April 18th, 1879.

A Sixpenny Phonograph.

When a great scientific discovery or invention is announced to the world, such, for example, as the telephone of Professor Graham Bell, the microphone of Professor Hughes, or the phonograph of Mr. Edison, it is pretty certain in a short time to be followed first by spurious and unauthorized imitations, which, if the invention be protected, are nothing more or less than direct infringements of the patent, and after that by highly interesting modifications of the apparatus either for the extension of the principle, developing further physical facts, or to analyze those already discovered; or else for the reduction of the instrument to its simplest possible form, so as to place in the hands of the teacher as well as in those of the million a scientific toy which can illustrate and render familiar the principle which lies at the base of the more important and typical apparatus.

There are few who can have failed to see that both the telephone and the microphone have gone through both these stages; and the phonograph, after having been imitated by amateurs and copied by unlicensed manufacturers, has led to the very beautiful analytical and synthetical apparatus of Mr. Stroh, and has quite recently re-appeared as a curious and most interesting scientific toy, and one which we would hesitate to say could not be made applicable to some useful purposes.

The very simple apparatus which we illustrate below is a speaking phonograph that can be made and sold for sixpence or even less, and yet leave a profit to the manufacturer. It is the invention of M. Lambrigot, an inspector of telegraphs at Albi, in the Department of Tarn, in the south of France, and has been brought to this country by M. Hospitalier, whose name is well known in connection with physical and electrical science.



The whole apparatus which is represented in Fig. 1 consists, first, of a hollow cone of pasteboard about $1\frac{1}{2}$ inch in diameter, whose apex is connected to the center of a similar-sized pasteboard disc by means of a lead wire about 16 inches long; and, second, of a small board or tablet, on which is fixed one, or a larger number of short lengths of lead wire, each of which bears upon its upper surface a phonographic embossed record corresponding to a certain word or sentence, by which it was originally produced by a process to be described further on.

To those who are familiar with the construction of the phonograph in the form in which it was first shown in this country, and which was fully described in these columns more than a year ago,* it would appear necessary, in order to reproduce the sounds recorded on the tablet, for the edge of the disc to be held in an annular frame so as to

* See "Engineering," Vol. XXV., page 186.

convert it into a diaphragm, and for its center to be thrown into vibration by means of a point or style projecting from it and drawn over the undulatory surface of the record. But the method of using the apparatus is far simpler than that; all that is necessary is to hold the paper cone against the ear with one hand and with the other to take hold of the cardboard disc, drawing its edge along the record with a steady scraping motion, and the mechanical vibrations thus set up in the disc being communicated by the wire to the conical ear-piece which serves as a resonator and concentrator, produce in the organs of hearing the sensation of the articulate sound by which the markings on the leaden record were originally produced. We should have thought that a stout thread or a lighter wire would have formed a more efficient as well as a cheaper connexion for the purpose than the lead wire, but we are informed that M. Lambrigot has found the lead to answer the purpose better than anything else; it does not require to be kept stretched between the cone and the disc, and being of a very inelastic nature it does not spring about and produce disturbing sounds by clashing against itself or against neighboring objects. Again, it would naturally be expected that the ear-piece would be more perfectly adapted to its purpose if it were in the form of that used in the ordinary thread telephone, that is to say, if it consisted of a cylindrical cardboard box closed at one end with a stretched paper diaphragm, to the center of which the connecting wire were attached; but simple as it is, this would undoubtedly be a more complex form of construction than the cardboard cones, and would be far more liable to be destroyed by the weight of the connecting wire. The employment of cardboard as the material of which the principal parts of the apparatus are constructed is, in the case of the cone, for cheapness, and in that of the disc partly for cheapness, but chiefly to protect the markings on the lead record from being destroyed, as they would soon be if a harder material than card were employed.

The most interesting point connected with this very simple apparatus is the method by which the leaden records are produced, which is as follows: The upper surface of a rectangular prism of glass, or other hard and rigid material, is thickly coated with stearine wax, which is then scraped into a convex form, as shown in the diagram Fig. 2, in which *a* represents the glass bar and *b* the convex coating of stearine. This bar is then fixed into a simple phonographic instrument which, by means of a screw or other mechanical contrivance, traverses it at a suitable speed below a diaphragm. This diaphragm is rigidly held around its circumference by an annular framework (not shown in the diagram), and is in every respect exactly similar to the diaphragm of an ordinary phonograph. To the center of this diaphragm is attached a thin flat plate, whose lower end is cut out to a

g. 1 consists, first, meter, whose apex and disc by means of a small board or of short lengths of ice a phonographic sentence, by which led further on. of the phonograph ountry, and which ear ago,* it would recorded on the ilar frame so as to

concave curve to fit the convex surface of the steering *b*. When all is properly adjusted, and the temperature is so arranged as to give to the stearine surface the proper degree of hardness to insure the desired results, the handle of the instrument is turned and at the same time words are spoken against the diaphragm, which immediately set up in it vibrations, which are communicated to the plate or style. While this is moving up and down, following the vibrations of the diaphragm caused by the voice, the stearine coating of the bar *a b* is steadily drawn in the direction of the arrow below the vibrating bar, receiving from it a phonogram similar to that produced on the tinfoil of an ordinary phonograph.

The stearine bar is then coated with a fine surface of plumbago so as to give to it an electrically conducting surface, and it is then electroplated with copper by the ordinary process. Out of the copper coating so formed the stearine is removed, and a rigid backing of lead or other metal having been run over the outside convex surface of the copper, a firm copper-lined matrix or mould is formed, the whole presenting the appearance shown in Fig. 3, and consisting of a rectangular block having along the center of one of its sides a semi-cylindrical groove *c* of copper which bears upon its surface certain raised striations corresponding to the depressions which were made by the diaphragm on the surface of the stearine. Into this groove is laid a piece lead wire of about 3 or 4 millimeters in diameter, and the two being put into a press and squeezed together the surface of the lead wire receives a permanent impression which is an exact reproduction of the original impression made upon the stearine bar. From one copper matrix a very large number of lead impressions may be made, and we are told that the whole process can be gone through and lead wires, each containing the record of a short sentence, can be made and sold with a profit for one halfpenny each.

It is an interesting fact that if a small stick of wood, such as the stem of a common match, be substituted for the disc shown in Fig. 1, and its end be drawn along the copper groove of one of the matrix moulds shown in Fig. 3, articulate speech is communicated equally well to the ear-piece, although the motion of the point is the reverse of that of the disc; and this bears a very close analogy to the fact that in the ordinary Bell telephone a message is transmitted with equal distinctness whether the poles of the receiving instrument be reversed or not.

We have had an opportunity of testing this simple little instrument, and the words come out of it with remarkable distinctness, though of course with but feeble power; and among the following words, all of which we have heard it utter, some were unmistakably clear; "Mon cher ami," "Louis Quatorze," "Victor Hugo," "La Republique,"

steering *b*. When all arranged as to give to ness to insure the best and at the same time immediately set up in plate or style. While tions of the diaphragm he bar *a b* is steadily vibrating bar, receiving on the tinfoil of an

surface of plumbago so e, and it is then electro- ut of the copper coating backing of lead or other surface of the copper, d, the whole presenting of a rectangular block semi-cylindrical groove in raised striations cor- by the diaphragm on s laid a piece lead wire e two being put into a e lead wire receives a duction of the original

"Octavie," "Bonjour," "Lambrigot," "Misérable," and "Miracle," and it is a curious fact that while in the phonograph the words "Phonograph" and "How do you do"? come out with exceptional distinctness, so in this instrument the words "Bonjour," and the name of the inventor, "Lambrigot," are the clearest of those we have heard.

It is not only fair to Mr. Edison, the inventor of the phonograph itself, to point out that the plan of producing a phonogram on a stearine surface, and afterwards reproducing it in copper by the process of electrolysis, was suggested by him long ago, but we do not understand that M. Lambrigot claims any novelty for that portion of the invention, but more especially for having produced a little instrument at the cost of a few pence, which can demonstrate the action of the phonograph and illustrate some of the most beautiful phenomena connected with the science of acoustics. We must congratulate M. Lambrigot on his success, and upon the very beautiful methods by which he has brought it about, and we hope before long his very interesting little instruments may find their way in large numbers to this country, for it is by the cheapest and simplest apparatus that some of the greatest discoveries of science are made, not on account of any intrinsic merit in cheapness, but because popular instruments, accessible to thousands, often give to individuals a first taste for scientific investigation, starting them on a research which may lead to great things, and out of the multitude of workers which such inventions instigate, some discoveries are well-nigh certain to be made.

In the United States Circuit Court
 Co. District of New York
 American Graphophone Co.
 National Graphophone Co.
 and Frank Seaman

In Equity.

Defendants Exhibit No. 20.

Guiseppi Litterer
 Notary public and
 special examiner

July 4, 1878]

NATURE

249

Dec. 26th 1879

LETTERS TO THE EDITOR

- [The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]
- [The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

The Phonograph

I HAVE received the following interesting letter from Dr. Blake, Boston, U.S.A. :—

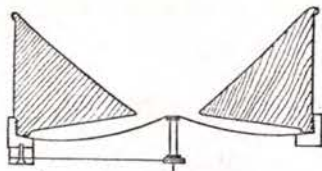
W. H. PREECE

"You may possibly be interested in some recent experiments which I have made with the phonograph, and unless you have been pursuing the same course, may find them worthy of repetition.

"I found that the groove in the cylinder, covered with tin-foil, became a resonator for the high scratching noise of the embossing point, materially interfering with the reproduction of the quality of the voice.

"By stretching a thin layer of rubber tissue over the cylinder this resonating effect was done away with and the scratching noise materially lessened. This experiment was new to Mr. Edison, and has since been repeated with like success.

"Since experiments made with the ferrotype telephone and phonograph-discs show that they transmit with almost astonishing accuracy the lighter over-tones of the human voice, but at the same time give especial prominence to certain over-tones to which the metal disc especially responds, I constructed a diaphragm upon the principle of the human drum membrane, to be used as a reproducing disc; the object being to employ a membrane which, from its structure and shape, would reproduce the lighter over-tones representing the quality of the voice, and at the same time 'cut off' the sharper exaggerated over-tones embossed as such by the metal disc upon the tin-foil. The results of the experiments with such a membrane were very



A small rod of light pine wood having a rubber pad at either end is placed between the boss which carries the embossing point and the centre of the membrane. This, the first form of disc constructed, worked very well.

gratifying. After embossing with the metal disc, the curved membrane was substituted, and the voice reproduced from the phonograph without the sharper over-tones, with much more natural and agreeable quality and with more than double intensity. On using the curved membrane for embossing as well as reproducing, I found, as would be expected, that the quality of the voice was more accurately represented, and that the embossing could be done at a distance of over fifteen feet from the phonograph, and be reproduced with clearness.

"Mr. Edison is now experimenting with this form of diaphragm, and, I understand, with very good results.

"The material used for these discs may be either stout felted paper (to be varnished on the outer surface when used for speaking) or drum-head, moistened and pressed into concave form before using. The principle governing the vibrations of such a disc is that of imparting the vibrations to the centre of a membrane the curve of which enables it to reproduce a large range of over-tones; its tension serving as a counterbalance to the central pressure.

"W. H. Preece, Esq., London."

"CLARENCE J. BLAKE

Physical Science for Artists

WITH reference to Mr. Norman Lockyer's and Prof. Brücke's observations on the appearance presented by the shadow of the

earth at sunset or sunrise (NATURE, vol. xviii. p. 223), I beg to be allowed to confirm them by my experience in Switzerland. Early starts for expeditions give one, among other good things, opportunities for seeing sunrise from the very beginning, and I have repeatedly seen the shadow of the earth, as it were, gradually driven down by the illuminated portion of the sky, the boundary between them being very well marked and roughly circular like the horizon, but I think with a greater apparent curvature. At this distance of time (some years) I cannot remember anything of an effect of foreshortening such as Prof. Brücke notices.

Once, in 1868, I saw an even more curious effect. As we stood at sunrise on a moderately sharp ridge running pretty closely north and south, at a height of 9,000 to 10,000 feet, there was an interval of appreciable duration in which it was a visible and striking fact that it was night on one side of the ridge and day on the other.

F. POLLOCK

Savile Club, Savile Row, W., June 27

Cyclones and Anticyclones

I WILL endeavour to put into a written form the ideas which have occurred to me respecting the law which, as I suppose, connects and governs the atmospheric phenomena which I see referred to in the newspapers as cyclones and anticyclones. I have seen it stated, as the result of observation, that in whatever direction the wind may be blowing at any given time, if you place your back to it the barometer will be found to stand lower upon your left than upon your right. I have also seen it stated that what are termed cyclones are rotatory movements of the air occasioned by the meeting and passing one another of two currents of air moving in opposite, or nearly opposite, directions, and that these cyclones or rotatory storms, though differing much in area, have certain features common to most, if not all, of them; namely, that the direction of their rotation is from right to left, or, in other words, the opposite of the motion of the hands of a watch, and that in their centre is found a considerable diminution of atmospheric pressure. On the other hand, in what is termed an anticyclone, the direction of the rotatory movement is in the opposite direction, that is, from left to right, or in the same direction as the movement of the hands of a watch, while in the central region the barometer is found to be standing high.

These various phenomena appear to me to be closely connected one with the other, and to be, in fact, due to the rotation of the earth upon its axis, which, having regard to its spherical form, makes it inevitable that the superincumbent air at the equator must rotate with the earth under it at a much greater velocity than that which is near the pole. For it seems evident that a current of air coming from the north travels into a region which is moving to the east more quickly than itself, and will therefore present itself as a north-east wind to the inhabitants of the more northern latitude, and not only so, but will tend to arrest the air on its right or westerly hand, while it is left or abandoned by the more quickly eastward-moving air on its left or easterly hand. This consideration will explain, so far as northerly winds are concerned, the first-mentioned of the phenomena above referred to, namely, the lower glass on the left hand, the higher glass on the right. Taking next the case of a northerly wind, it will be obvious that in travelling northward it comes to a country moving westward more slowly than itself, and consequently appears as a north-west wind to the people over whose land it passes; and not only so, but by pressing on the air to the right, or eastward side, it increases pressure in that direction, while it tends to leave behind the more slowly moving air on its left, or westward side, thus again producing the first-mentioned phenomenon of a high glass on the right and a low glass on the left, so far as southerly winds are concerned. If this principle is considered with reference to a cyclone and the direction of the rotatory movement is also taken into account, it seems to be made clear that a cyclone is occasioned by the meeting and passing each other of a northerly and southerly current so that they pass each other on the left hand respectively.

When this occurs the low pressure on the left or east side of the north wind coincides with the low pressure on the left or west side of the south wind, and thus a depression is formed round which the wind rotates. It follows that the west and south wind is found in the south and south-east side of the storm,

U.S.C.C. E.D. of Pa.

American Graphophone Co. vs Berliner Gramophone Co., et als.
Defendants' Exhibit No. 21, The Telegraph, Microphone and
Phonograph by Du Moncel, Published by Harper Bros., A.D. 1879
p. 247-248.

CLOCK-WORK SYSTEM.

gy. The tenuity of the vibrating disk adds to the efficiency of the instrument, and the tracing-point may be fitted directly to this disk.

I need not describe particularly the phonograph which acts by clock-work. The instrument resembles the one represented in Fig. 66, except that it is mounted on a rather high table, to give room for the descent of the weight which moves the clock-work; the mechanism is applied directly to the axis of the cylinder, supplying the place of the winch, and is regulated by a small fly-wheel. The wheel used in an English system has been adopted, but we prefer that of M. Villarcean, which has small wings.

Since it is always difficult to fit the tin-foil to the cylinder, Mr. Edison has tried, with good success, to obtain the tracing on a plane surface of tin-foil, by means of the arrangement represented in Fig. 69. In this new model, the plate on which

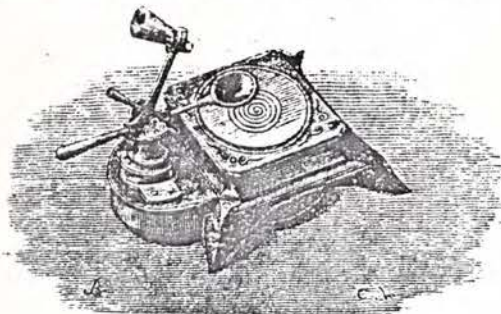


FIG. 69.

the tin or copper sheet is to be applied has a spiral grooving, of which one end corresponds to the centre of the plate, and the other to its outer edges. The plate is set in motion by a powerful system of clock-work, of which the velocity is regulated with reference to the length of the turns of the spiral. The vibrating disk is arranged as in the former instrument, and

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is placed above this plate; the tracing-point may, by means of a movement of progression imparted to the system, follow the spiral groove from the centre of the plate to its circumference.

It must not be supposed that all the tin-foil used for phonographic registration is equally good. The foil must be of a definite thickness, and combined with a definite amount of lead. That which is used for wrapping chocolate, and indeed all foil of French manufacture, is too thin and too exclusively made of

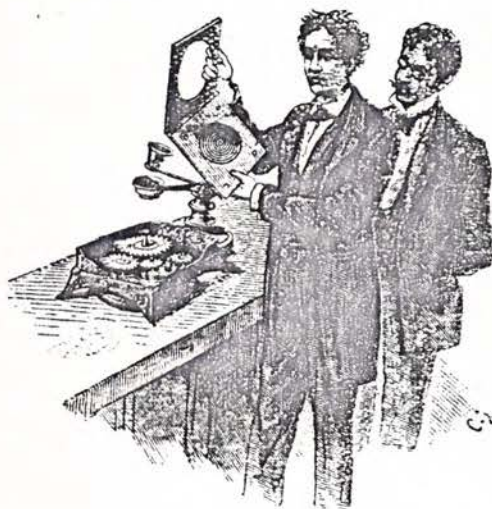


FIG. 70.

tin to produce good results, and M. Puskas was obliged to import some from America to continue his experiments. The relative proportion of lead and tin has not yet been defined, and the selection of foil has been made empirically; but as the use of the phonograph becomes more general, this proportion must be ascertained, and it may easily be done by analyzing the composition of the foil which gives the best results.

Exhibit #22

James P. Lee
J. P. Lee

- The Telephone, Microphone and Phonograph-
By Count Du Moncel.

Harper Brothers; Publishers, Franklin Square.

Page 238-

1879.

Mr. Edison's phonograph was only patented in January 1877. Consequently, when we look at the principle of the invention, Mr. Cros undoubtedly may claim priority; but it is a question whether the system described in his sealed paper, and published in the Semaine du Clerge Oct. 8, 1877, would have been capable of reproducing speech. Our doubt seems justified by the unsuccessful attempts of the Abbi Lebalne to carry out M. Cros' idea. When we have to do with such undulations and complex vibrations as those involved in the reproduction of articulate words, it is necessary that the stereotyping should in some sense be effected by the words themselves, and their artificial reproduction will necessarily fail to make the slight differences which distinguish the delicate combinations of speech. Besides the movements performed by a point confined to a groove that follows a sinusoidal curve cannot be effected with all the freedom necessary for the development of sounds and the friction exerted on the two edges of the groove will often be of a nature to stifle them. A distinguished member of the Societe de Physique when I exhibited the phonograph to that Society, justly said that Mr. Edison's whole inven-

In Equity
Custodian of the
National Public and
Official Archives
Dec 26th 1894

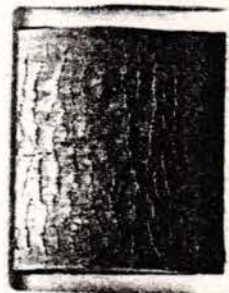
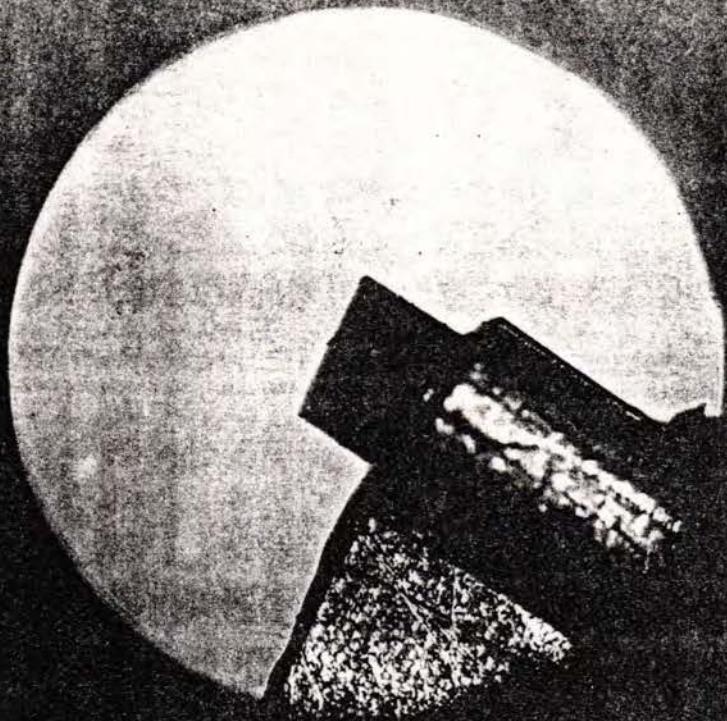
In the United States Circuit Court
for the District of New York.
American Graphophone Co.
vs.
Berliner Gramophone Co. and Frank Seaman
Defendants' Exhibit No. 22

tion consisted in the thin metallic sheet on which the vibrations are inscribed; this sheet permits the movements of the vibrating plate to be directly stereotyped, and thereby the problem is solved. It was necessary to find such an expedient and it was done by Mr. Edison, who is therefore the inventor of the phonograph.

U. S. C. C. E. D. of Pa.
American Graphophone Co. vs. Berliner Gramophone Co. et als.
Defendants' Exhibit No. 24, Chapman Photographs
Graphophons Grooves.

James S. Bell
J. S. Bell





U.S.C.G. E.D. of Pa.
American Graphophone Co.

vs

Berliner Gramophone Co. et al.
Defts. Ex. 25. Graphophone Cutting
Style and Scale Photograph.

Samuel J. Bell
Ap. Ex.

Gramophone Grooves



Graphophone Grooves



Am. Graph. Co. v Berliner Co. et al

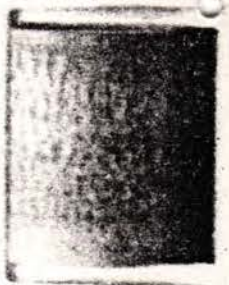
Defendants Exhibit No. 26

~~In the U.S. Circuit Court
for the District of New York
American Graphophone Co.,
National Graphophone Co., } In Equity
vs Frank Seaman
Defendants' Exhibit No. 26.
Drawing of Graphophone & Gramophone Grooves.
Gustave S. Williams
notary public & special examiner
April 23, 1900~~



U.S.C.C. E. D. of Pa.
American Gramophone Co. vs
Berliner Gramophone Co. et als.
Defts.Ex. #27. Graphophone Reproducer
Style and Scale Photograph.

Lawrence H. Bell
W. B. E. D.



U. S. C. C. E. D. of Pa.

American Graphophone Co. vs. Berliner Gramophone Co., et als.

Defendants' Exhibit #28, Berliner U. S. Patent No. 564,586.

James P. Lee
for Ex.

Eh 28

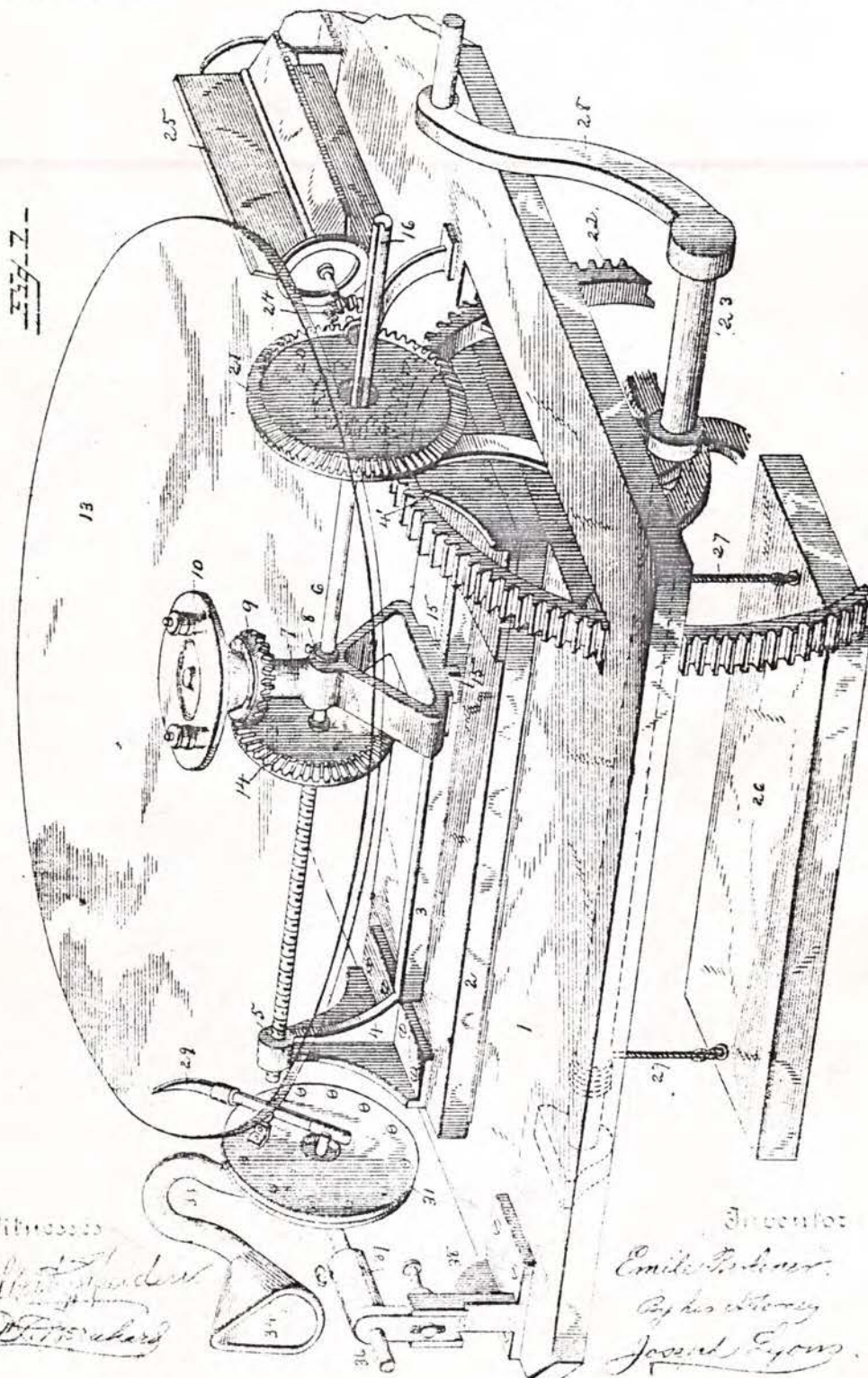
(No Model.)

3 Sheets—Sheet 1.

E. BERLINER.
GRAMOPHONE.

No. 564,586.

Patented July 28, 1896.



Witnesses
Wm. H. Spence
Edw. H. Spence

Inventor
Emile Berliner
By his attorney
Joseph E. Goss

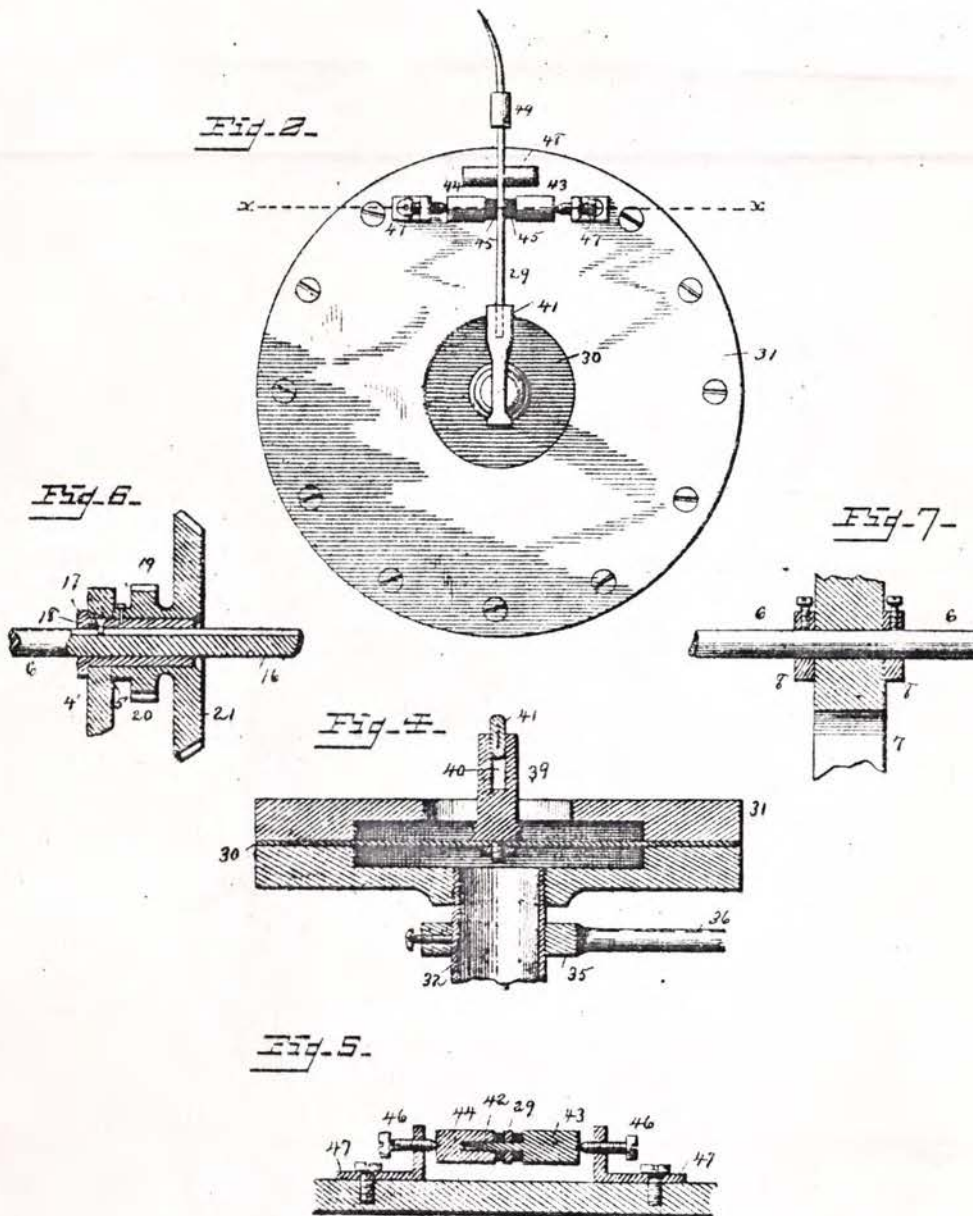
(No Model.)

E. BERLINER.
GRAMOPHONE.

3 Sheets—Sheet 2.

No. 564,586.

Patented July 28, 1896.



Witnesses

Albert Spidner
E. H. Henshaw

Inventor

Emile Berliner

By his Attorney

Joseph Lyons

(No Model.)

3 Sheets—Sheet 3.

E. BERLINER.
GRAMOPHONE.

No. 564,586.

Patented July 28, 1896.

Fig. 9.

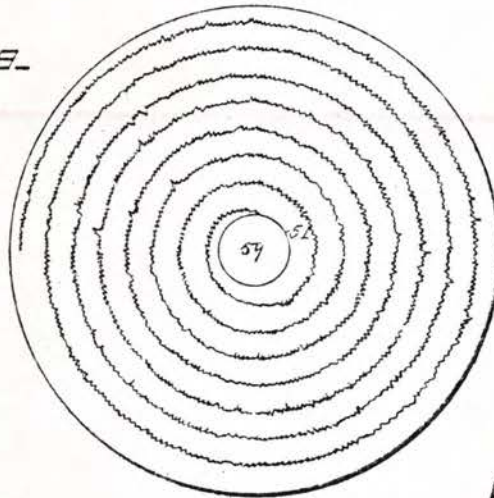


Fig. 8.

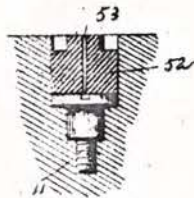


Fig. 10.

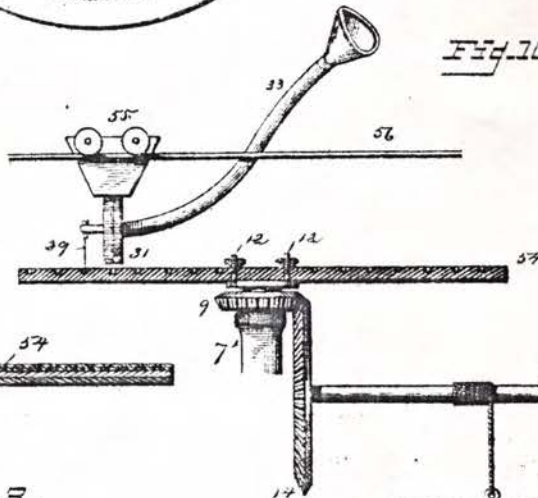
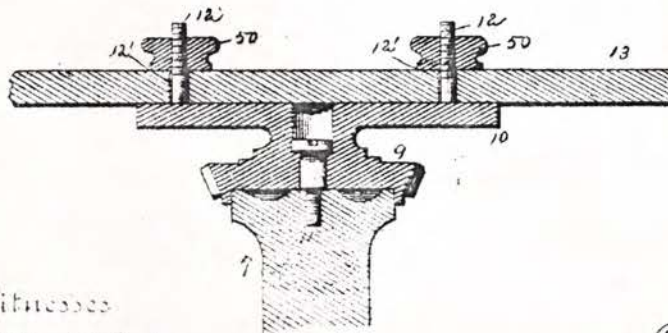


Fig. 11.



Fig. 12.



2 Witnesses

Alfred Spindler
Ed. F. Forster

Inventor

Emile Berliner

By his Attorney

Joseph Lyons

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR.
BY MESNE ASSIGNMENTS, TO THE UNITED STATES GRAMOPHONE COM-
PANY, OF WEST VIRGINIA.

GRAMOPHONE.

SPECIFICATION forming part of Letters Patent No. 564,586, dated July 29, 1896.

Application filed November 7, 1887. Serial No. 254,541. (No model.) Patented in England November 8, 1937. No. 15,233.

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Gramophones, of which the following is a specification.

My invention has reference to improvements in methods of and apparatus for recording and reproducing spoken words and other sounds, and it is primarily intended as and constitutes an extension and improvement of my gramophone which I have described in Letters Patent No. 372,786, granted to me on November 8, 1887, and for which I have also received Letters Patent of Great Britain, No. 15,232, dated November 8, 1887. In said patents I have described a method of recording and reproducing sounds, which consists in first causing the sounds to inscribe themselves upon a layer of non-resisting material in a manner substantially like that practiced by the well-known Leon Scott, phonautograph, then copying the phonautographic record in solid resisting material, preferably by the photo-engraving process, and then reproducing the sounds from the solid copy of the record. The original record, as well as the copy of the same, is thus obtained as an undulatory line of even depth, as distinguished from a line of varying depth obtained by the ordinary phonograph and by the graphophone.

In my present invention I retain all the fundamental features of my gramophone, but introduce certain novel features both in the process and in the apparatus, which render the attainment of the objects of a sound recorder and reproducer more certain and more perfect.

In the original form of my gramophone I employed a curved (cylindrical) surface upon which the non-resisting medium used for recording was supported. This had the disadvantage that for the purpose of copying the record by the photo-engraving process, such surface had to be first straightened and the flat copy obtained from the same had to be bent again to the original cylindrical form of the record-surface. This involved delicate and tedious manipulations, which I avoid in

my present invention by inscribing the record of sounds upon a flat plate, and I further improve the process by arranging that flat plate horizontally, or nearly so, and by inscribing the record upon the under surface of the same, whereby the material removed by the recording-stylus drops away from the plate and leaves the undulatory groove of even depth, clean, and well defined, whereas by the old method the material removed by the stylus accumulated in and about the adjacent grooves.

I have further improved the process by using a transparent plate as a support for the non-resisting medium. This plate is therefore made either of glass or some other like substance, whereby I secure several important advantages. The most important of these advantages is that it enables me to work with parallel transmitted rays of light in the subsequent process of photo-engraving, in which the original record is thus used as a negative, which may be directly applied in contact with the sensitive photographic plate, and another important advantage is the reduction of the friction of the stylus upon the supports to a minimum.

The process is further improved by the employment of a new recording medium. In the original process I used a layer of lampblack pure and simple, and this substance is well adapted for the purpose on account of the slight coherence of the particles; but by reason of the flocculent nature of this substance the lines drawn upon it are more or less ragged, as can be observed under a microscope, and the photo-engraving obtained from such record displays all the defects of the original. In my improved process I employ a layer of a semifluid ink or paint, of such consistency and thickness that it will neither subside nor flow spontaneously. Such ink is practically structureless, and the lines drawn upon it are exceedingly sharp and reveal no ragged edges under a powerful microscope, and the photo-engraving from such record is far superior to a like copy from a record produced under the former process.

My invention also comprises other minor improvements in the process, and it also comprises novel features in the apparatus, all of which

will more fully appear from the following detailed description, in which reference is made to the accompanying drawings, in which I have illustrated convenient forms of apparatus which I have used, without, however, limiting myself to the exact details of the same.

Figure 1 is a perspective view of my improved gramophone. Fig. 2 is a plan view of the diaphragm, with its support and accessories. Fig. 3 is a vertical section showing the recording-disk and its connection with the driving-wheel. Fig. 4 is a sectional view of the diaphragm, its support, and accessories. Fig. 5 is a cross-section on line *x x* of Fig. 2. Fig. 6 is a sectional view of a part of the driving-gear. Fig. 7 is a section showing the connection of the driven shaft with the support of the recording-disk. Fig. 8 is a sectional view of a centering device. Fig. 9 is a plan view, upon a reduced scale, of a disk with a record of sounds recorded upon the same in accordance with my invention. Fig. 10 is a sectional elevation of a modified form of my reproducing apparatus, and Fig. 11 is a sectional view of a dampened reproducing-disk.

Referring now to the drawings, in which the details are marked by numerals, there is a platform 1, suitably supported, and upon this platform are mounted the operative parts of the apparatus. A metallic plate 2, provided with a longitudinal rib 3, is secured upon the platform, and standards 4 4', mounted upon plate 2, are provided with a nut-bearing 5 and a smooth bearing 5', (see Fig. 6,) respectively, for shaft 6, which extends through these bearings, as shown. One-half, more or less, of this shaft is screw-threaded, as shown, and enters the nut-bearing 5, and at a point near the middle said shaft passes loosely through a movable support 7, the position of which upon the shaft is determined by two collars 8 8, as indicated in Fig. 7.

The support 7 serves as a bearing for a bevel-gear 9, which is centrally perforated and widens out into a circular flange 10. Upon its under side the bevel-gear 9 is recessed, and said recess fits loosely over the upper end of support 7. A screw 11, passing loosely through the central perforation of bevel-gear 9, screws into the head of support 7, so that the bevel-gear can rotate about its axis, which coincides with the axis of screw 11. Two screw-pins 12 12, which may be either fixed or removable, project at diametrically opposite points from flange 10, and are designed to pass through two similarly located holes in a glass plate 13, as will be more fully described hereinafter.

A bevel-gear 14, fixed upon shaft 6, engages bevel-gear 9. For provision is made for releasing gear 14 from the shaft, if desired, for a purpose which will be explained farther on. As stated above, the screw-threaded portion of shaft 6 passes through nut-bearing 5, and it will now be clear that if shaft 6 is rotated bevel-gear 9, with its flange 10, will likewise rotate, and will at the same time ad-

vance in a straight line, since shaft 6, screwing into or out of its nut-bearing 5, will carry bevel-gear 14 and support 7 with it. From the bottom of support 7 two lugs 15 15, one on each side of rib 3 of plate 2, serve to guide the support with the parts attached thereto in the line of said rib, which is, of course, parallel to shaft 6.

A part of the smooth portion of shaft 6 has a longitudinal groove 16 extending to the right hand end of the shaft, as seen in Figs. 1 and 6, and a sleeve 17, loosely fitting this portion of the shaft has a pin 18, the end of which engages groove 16, as shown in Fig. 6, so that the shaft is free to slide longitudinally through sleeve 17 and will rotate with the same if the latter is rotated.

Sleeve 17 is fitted into bearing 5' of stand 4, and 4', so as to rotate within the same, and upon that part of the sleeve which projects beyond the bearing is keyed the compound gear 19. The latter is composed of a pinion 20 and a bevel-gear 21, and a rather large bevel-wheel 22, mounted upon a shaft 23 below platform 1, meshes with pinion 20.

A small bevel-gear 24 meshes with gear-wheel 21, and to the shaft of gear 24 are secured fans 25, which are thus driven at a high speed and serve as a regulator, as will be readily understood by those skilled in the art.

A weight 26 is suspended by cords or chains 27 from shaft 23, and if said shaft is turned by a crank 28, or otherwise, in one direction the cords or chains are wound upon the same, as indicated in Fig. 1, and the weight 26 is raised up toward the platform. If, on the other hand, the weight is allowed to descend, it will rotate shaft 23, this in turn will rotate gear-wheel 22, which, meshing with pinion 20, will rotate the latter and the connected shaft 6, and in the manner hereinbefore described support 7 will receive a rectilinear motion, while flange 10, upon bevel-gear 9, will both rotate and move in a straight line. For every complete revolution of bevel-gear 14 support 7 and bevel-gear 9, with its connected flange 10, will be moved in the line of a diameter a distance equal to the pitch of the screw-threads upon shaft 6, and it will now be understood that if a plate 13 is fixed to flange 10 and a fixed pencil or stylus be lightly pressed upon the plane surface of said plate a spiral line will be drawn upon the plate.

The recording stylus 29 is arranged upon a diaphragm 30, and the diaphragm 30, which may be of any suitable substance, is mounted in a case 31, and a pencil 32, projecting from one side of the case, communicates with a flexible tube 33 and a mouth or ear piece 34. The diaphragm and may be adjusted in its position at its length in a ring 35, formed at the end of a rod 36, which is adjustable in a support 37, and the latter is again adjustable vertically in a standard 38 mounted upon platform 1. A

will more fully appear from the following detailed description, in which reference is made to the accompanying drawings, in which I have illustrated convenient forms of apparatus 5 which I have used, without, however, limiting myself to the exact details of the same.

Figure 1 is a perspective view of my improved gramophone. Fig. 2 is a plan view of the diaphragm, with its support and accessories. Fig. 3 is a vertical section showing the recording-disk and its connection with the driving-wheel. Fig. 4 is a sectional view of the diaphragm, its support, and accessories. Fig. 5 is a cross-section on line *x x* of Fig. 2. Fig. 6 is a sectional view of a part of the driving-gear. Fig. 7 is a section showing the connection of the driven shaft with the support of the recording-disk. Fig. 8 is a sectional view of a centering device. Fig. 9 is a plan view, upon a reduced scale, of a disk with a record of sounds recorded upon the same in accordance with my invention. Fig. 10 is a sectional elevation of a modified form of my reproducing apparatus, and Fig. 11 is a sectional view of a dampened reproducing-disk.

Referring now to the drawings, in which the details are marked by numerals, there is a platform 1, suitably supported, and upon this platform are mounted the operative parts of the apparatus. A metallic plate 2, provided with a longitudinal rib 3, is secured upon the platform, and standards 4 4', mounted upon plate 2, are provided with a nut-bearing 5 and a smooth bearing 5', (see Fig. 6,) respectively, for shaft 6, which extends through these bearings, as shown. One-half, more or less, of this shaft is screw-threaded, as shown, and enters the nut-bearing 5, and at a point near the middle said shaft passes loosely through a movable support 7, the position of which upon the shaft is determined by two collars 8 8, as indicated in Fig. 7.

The support 7 serves as a bearing for a bevel-gear 9, which is centrally perforated and widens out into a circular flange 10. Upon its under side the bevel-gear 9 is recessed, and said recess fits loosely over the upper end of support 7. A screw 11, passing loosely through the central perforation of bevel-gear 9, screws into the head of support 7, so that the bevel-gear can rotate about its axis, which coincides with the axis of screw 11. Two screw-pins 12 12, which may be either fixed or removable, project at diametrically opposite points from flange 10, and are designed to pass through two similarly located holes in a glass plate 13, as will be more fully described hereinafter.

A bevel-gear 14, fixed upon shaft 6, engages bevel-gear 9, but provision is made for releasing gear 14 from the shaft, if desired, for a purpose which will be explained farther on. As stated above, the screw-threaded portion of shaft 6 passes through nut-bearing 5, and it will now be seen that if shaft 6 is rotated bevel-gear 14, with its flange 10, will likewise rotate, and will at the same time ad-

vance in a straight line, since shaft 6, screwing into or out of its nut-bearing 5, will carry bevel-gear 14 and support 7 with it. From the bottom of support 7 two lugs 15 15, one on each side of rib 3 of plate 2, serve to guide the support with the parts attached thereto in the line of said rib, which is, of course, parallel to shaft 6.

A part of the smooth portion of shaft 6 has a longitudinal groove 16 extending to the right-hand end of the shaft, as seen in Figs. 1 and 6, and a sleeve 17 loosely fitting this portion of the shaft has a pin 18, the end of which engages groove 16, as shown in Fig. 6, so that the shaft is free to slide longitudinally through sleeve 17 and will rotate with the same if the latter is rotated.

Sleeve 17 is fitted into bearing 5' of standard 4', so as to rotate within the same, and upon that part of the sleeve which projects beyond the bearing is keyed the compound gear 19. The latter is composed of a pinion 20 and a bevel-gear 21, and a rather large bevel-wheel 22, mounted upon a shaft 23 below platform 1, meshes with pinion 20.

A small bevel-gear 24 meshes with gear-wheel 21, and to the shaft of gear 24 are secured fans 25, which are thus driven at a high speed and serve as a regulator, as will be readily understood by those skilled in the art.

A weight 26 is suspended by cords or chains 27 from shaft 23, and if said shaft is turned by a crank 28, or otherwise, in one direction the cords or chains are wound upon the same, as indicated in Fig. 1, and the weight 26 is raised up toward the platform. If, on the other hand, the weight is allowed to descend, it will rotate shaft 23, this in turn will rotate gear-wheel 22, which, meshing with pinion 20, will rotate the latter and the connected shaft 6, and in the manner hereinbefore described support 7 will receive a rectilinear motion, while flange 10, upon bevel-gear 9, will both rotate and move in a straight line. For every complete revolution of bevel-gear 14 support 7 and bevel-gear 9, with its connected flange 10, will be moved in the line of the diameter a distance equal to the pitch of the screw-threads upon shaft 6, and it will now be understood that if a plate 13 is fixed to flange 10 and a fixed pencil or stylus be lightly pressed upon the plane surface of said plate a spiral line will be drawn upon the plate.

The recording-stylus 29 is mounted upon a diaphragm 30, and the diaphragm itself, which may be of any suitable sonorous material, is mounted in a case 31, and a right tube 32, projecting from one end of the case, communicates with a flexible tube 33 and a mouth or ear piece 34. The tube is clamped and may be adjusted in the direction of its length in a ring 35, formed at the end of a rod 36, which is adjustable in a support 37, and the latter is again adjustable vertically in a standard 38 mounted upon platform 1. A

An approximate idea of the phonautogram thus produced can be obtained by inspection of fig. 9, which represents an undulatory spiral line upon a disk, with the pitch of the spiral and the undulations of the record greatly exaggerated. In the drawings, the undulatory line appears black upon a white ground, while in fact the line is transparent upon a black ground.

The phonautogram may extend to within a short distance from the edge of flange 10, and in practice the cords or chains 27 27 are made just long enough to drive the disk up to that limit, or the apparatus is mounted at the proper height above the ground so that the weight will be arrested before the limit of progress of the disk is reached. Bevel-gear 14 is then disengaged from bevel-gear 9 by unclamping the same from shaft 6 and sliding it upon the same a short distance to the left hand, (in the view shown in Fig. 1.) and the disk is then given a single rotation by hand, whereby the stylus describes a true circle 51 upon the disk. This circle, which I call the "centering-circle," is afterward utilized, as will presently appear. The glass disk, with the sound-record and centering-circle upon the same, is now removed, and the record may be fixed by applying a thin coat of varnish. It may then be handled with impunity. From this record I produce a copy in copper or any other metal by the process of photo-engraving, and in this process I use the original record as a negative, which enables me to work by transmitted light and with parallel rays, the negative being applied directly in contact with the sensitive photographic plate. The copy thus produced will have the exact size of the original, as is well understood by those skilled in the art. In the photo-engraved copy the sound-record appears as an undulatory line of even depth upon a solid metal disk, and the centering-circle 51 is reproduced in the same manner.

For reproducing the original sounds, the center of the centering-circle is determined by well-known simple geometrical constructions, and a small hole is drilled through that center, which hole corresponds to the mathematical axis about which the glass disk had been rotated, and also marks the axis about which the metal disk must be rotated by the apparatus shown in order that the pointed stylus applied to the starting-point of the record may follow the same from beginning to end. Two holes corresponding to the holes 12' 12' in the glass-disk are also made in the metal disk, but these holes are preferably made large enough to permit the disk to be adjusted in either direction when placed upon flange 10. Before this is done a well-fitting cylindrical block 52 is placed into that part of the disk through the common center of flange 10 and bevel-gear 9 which is occupied by the head of screw 11, as shown in Fig. 8. This block, which I call

the "centering-block," has a fine axial hole 53, which corresponds exactly to the mathematical axis of rotation of bevel-gear 9. If now the photo-engraved copy of the record is placed upon flange 10, with pins 12 12 passing through corresponding holes in the metal plate, a fine pin, say a sewing-needle, is passed through the centering-holes in the disk and in block 52, and the clamp-nuts 50 are tightly screwed down. By this simple process the metallic copy of the original record is safely and quickly centered in position. The stylus is then adjusted with its point in engagement with the outer end of the record-groove, and the weight 20 is allowed to descend. It will now be clear that the stylus will be forced positively to follow the undulations of the record, and that the diaphragm vibrating under the stylus will emit the same sounds which produced the original record, which sounds can be distinctly heard at the ear-piece 34.

Both the process and the apparatus thus far described may be modified in various ways without departing from the main features of my invention. So, for instance, I can dispense with the centering device and can rotate the record upon a stationary axis, if the diaphragm with its attached stylus is mounted in a manner to make it follow the spiral record. An arrangement of this character is shown in Fig. 10. The reproducing-disk 54 is in this case mounted as hereinbefore described, but without regard to the centering device. The support 7' may be fixed in position so that the bevel-gear 9, mounted upon the same in the manner described with reference to Fig. 3, will turn without progressive motion. Bevel-gear 9, and with it the reproducing-disk 54, are rotated by a bevel-gear 14' upon a shaft 6', to which power is applied by a weight, as shown, or in any other suitable manner. The diaphragm-casing 31 is secured to a small truck 55 upon rails 56 arranged vertically above and parallel with a diameter of the reproducing-disk, and at such height above the same that the stylus 29 will be in engagement with the undulatory grooves of even depth which represent the record of sounds.

The listener applies his ear to the ear-piece, and when the shaft 6' is rotated the stylus and diaphragm will be forced to vibrate, as in the apparatus shown in Fig. 1, but will at the same time move with the truck 55 across the face of disk 54. A tolerably good reproduction may also be obtained by simply holding one end of a reed between the teeth and the other pointed end of the same in engagement with the record-grooves, as the disk is rotated.

The frictional contact of the reproducing-stylus with the surface of the ordinary metal record gives rise to disturbing sounds, and with a view of avoiding the same I mount the reproducing-disk 54 (see Fig. 11) upon a rigid plate 58, and with a sheet 57, of

An approximate idea of the phonautogram thus produced can be obtained by inspection of Fig. 9, which represents an undulatory spiral line upon a disk, with the pitch of the spiral and the undulations of the record greatly exaggerated. In the drawings, the undulatory line appears black upon a white ground, while in fact the line is transparent upon a black ground.

The phonautogram may extend to within a short distance from the edge of flange 10, and in practice the cords or chains 27 27 are made just long enough to drive the disk up to that limit, or the apparatus is mounted at the proper height above the ground so that the weight will be arrested before the limit of progress of the disk is reached. Bevel-gear 14 is then disengaged from bevel-gear 9 by unclamping the same from shaft 6 and sliding it upon the same a short distance to the left hand, (in the view shown in Fig. 1,) and the disk is then given a single rotation by hand, whereby the stylus describes a true circle 51 upon the disk. This circle, which I call the "centering-circle," is afterward utilized, as will presently appear. The glass disk, with the sound-record and centering-circle upon the same, is now removed, and the record may be fixed by applying a thin coat of varnish. It may then be handled with impunity. From this record I produce a copy in copper or any other metal by the process of photo-engraving, and in this process I use the original record as a negative, which enables me to work by transmitted light and with parallel rays, the negative being applied directly in contact with the sensitive photographic plate. The copy thus produced will have the exact size of the original, as is well understood by those skilled in the art. In the photo-engraved copy the sound-record appears as an undulatory line of even depth upon a solid metal disk, and the centering-circle 51 is reproduced in the same manner.

For reproducing the original sounds, the center of the centering-circle is determined by well-known simple geometrical constructions, and a small hole is drilled through that center, which hole corresponds to the mathematical axis about which the glass disk had been rotated, and also marks the axis about which the metal disk must be rotated by the apparatus shown in order that the pointed stylus applied to the starting-point of the record may follow the same from beginning to end. Two holes corresponding to the holes 12' 12' in the glass-disk are also made in the metal disk, but these holes are preferably made large enough to permit the disk to be adjusted in either direction when placed upon flange 10. Before this is done a well-fitting cylindrical block 52 is placed into that part of the cylindrical hole through the common center of flange 10 and bevel-gear 9 which is occupied by the head of screw 11, as shown in Fig. 8. This block, which I call

the "centering-block," has a fine axial hole 53, which corresponds exactly to the mathematical axis of rotation of bevel-gear 9. If now the photo-engraved copy of the record is placed upon flange 10, with pins 12 12 passing through corresponding holes in the metal plate, a fine pin, say a sewing-needle, is passed through the centering-holes in the disk and in block 52, and the clamp-nuts 50 are tightly screwed down. By this simple process the metallic copy of the original record is safely and quickly centered in position. The stylus is then adjusted with its point in engagement with the outer end of the record-groove, and the weight 26 is allowed to descend. It will now be clear that the stylus will be forced positively to follow the undulations of the record, and that the diaphragm vibrating under the stylus will emit the same sounds which produced the original record, which sounds can be distinctly heard at the ear-piece 34.

Both the process and the apparatus thus far described may be modified in various ways without departing from the main features of my invention. So, for instance, I can dispense with the centering device and can rotate the record upon a stationary axis, if the diaphragm with its attached stylus is mounted in a manner to make it follow the spiral record. An arrangement of this character is shown in Fig. 10. The reproducing-disk 54 is in this case mounted as hereinbefore described, but without regard to the centering device. The support 7' may be fixed in position so that the bevel-gear 9, mounted upon the same in the manner described with reference to Fig. 3, will turn without progressive motion. Bevel-gear 9, and with it the reproducing-disk 54, are rotated by a bevel-gear 14' upon a shaft 6', to which power is applied by a weight, as shown, or in any other suitable manner. The diaphragm-casing 31 is secured to a small truck 55 upon rails 56 arranged vertically above and parallel with a diameter of the reproducing-disk, and at such height above the same that the stylus 29 will be in engagement with the undulatory grooves of even depth which represent the record of sounds.

The listener applies his ear to the ear-piece, and when the shaft 6' is rotated the stylus and diaphragm will be forced to vibrate, as in the apparatus shown in Fig. 1, but will at the same time move with the truck 55 across the face of disk 54. A tolerably good reproduction may also be obtained by simply holding one end of a reed between the teeth and the other pointed end of the same in engagement with the record-grooves while the disk is rotated.

The frictional contact of the reproducing-stylus with the surface of the original undulatory record gives rise to distinct sounds, and with a view of avoiding the same I mount the reproducing-disk 54, as in Fig. 11, upon a rigid plate 58, and with a sheet 57, of

graphic record of spoken words or other sounds; with a backing of non-resonant material; substantially as described.

13. In a gramophone, the combination of a sound-receiving diaphragm, mounted in a suitable casing; with a tubular sound-conveying stem projecting from the casing, and an adjustable support for the tubular stem; the connection between the casing and tubular stem being such as to permit of the rotation of the casing relative to the stem for adjustment, substantially as described and for the purpose set forth.

15 16. A device for centering a spirally-extending record, of sounds upon a reproducing

apparatus, consisting of a rotatable record-support having a central recess, a block fitting the said recess and having a perforation coincident with the mathematical center of rotation of the record-support, and means for holding the record upon the support, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMILE BERLINER.

Witnesses:

JACOB G. COHEN,
CHAS. W. HANDY.

Fig. 1.

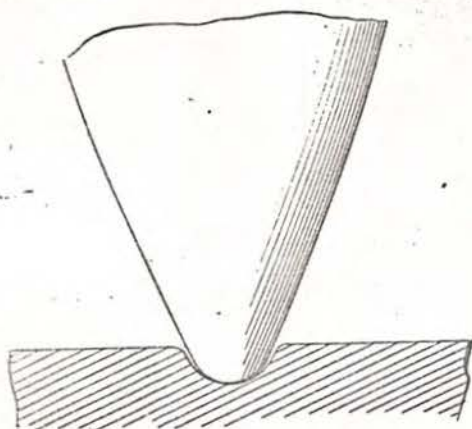


Fig. 2.

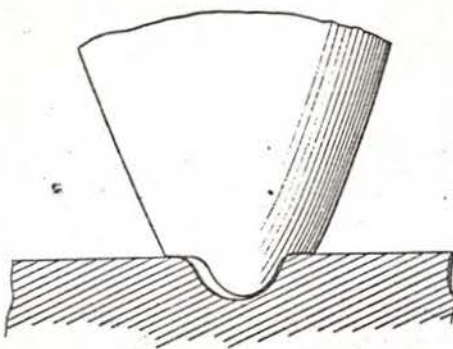


Fig. 3.

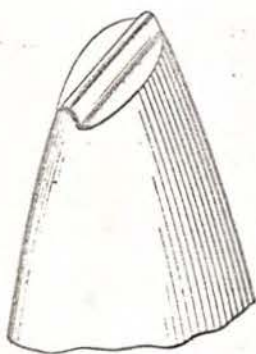
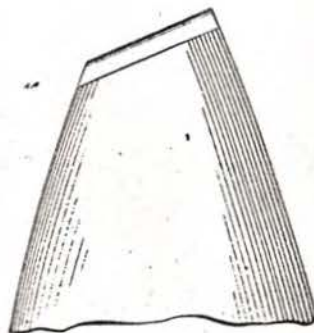


Fig. 4.

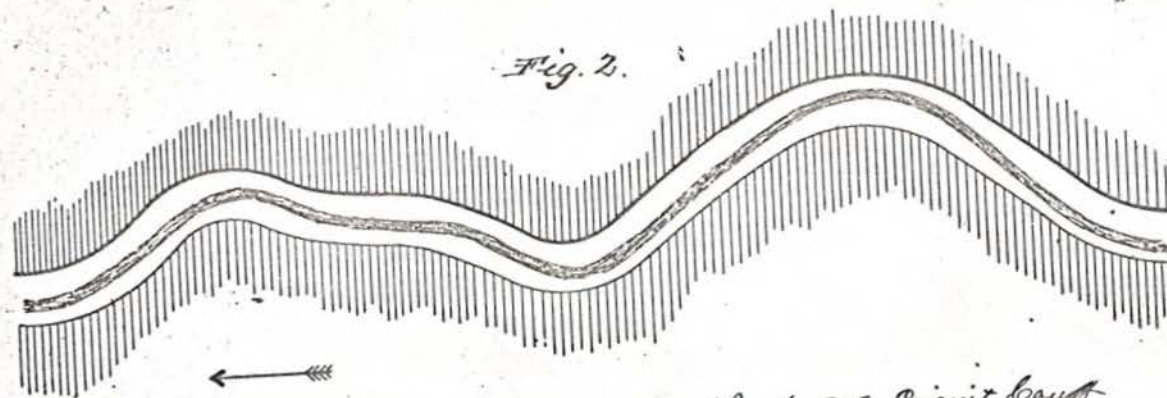
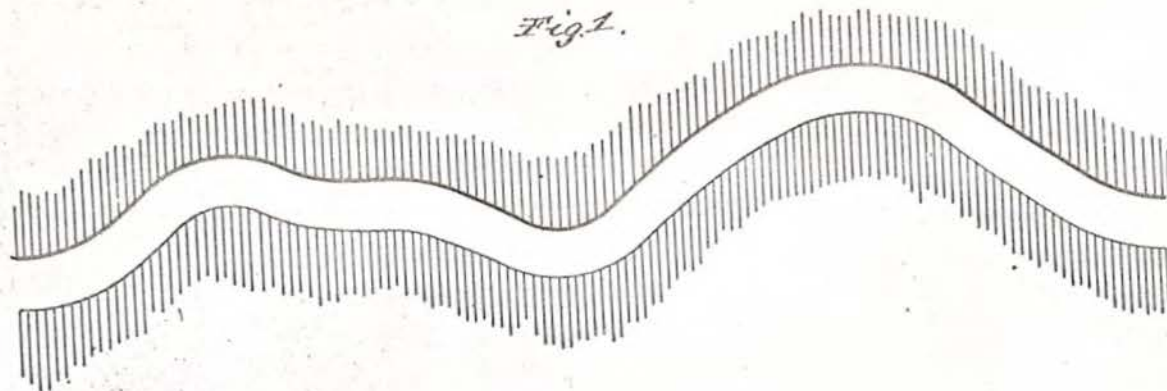


Am. Graph. Co. v Berliner Co. et al

Defendants Exhibit No. 29

~~In the U.S. Circuit Court
In District of New York
American Graphophone Co.,
National Graphophone Co., } In Equity
vs Frank Seaman~~

~~Defendants' Exhibit No. 29,
Drawing of Graphophone Groove in Style.
Ernest Sittman
notary public & special examiner
April 23, 1900~~



Am Graph. Co. v Berliner Co. et al

Defendants Exhibit No. 30

~~In the U.S. Circuit Court
So. District of New York~~

~~American Gramophone Co.,
vs.
National Gramophone Co.,
by Frank Deamant~~

~~Defendants' Exhibit No. 30~~

~~April 23d 1900.~~

~~In Equity.~~

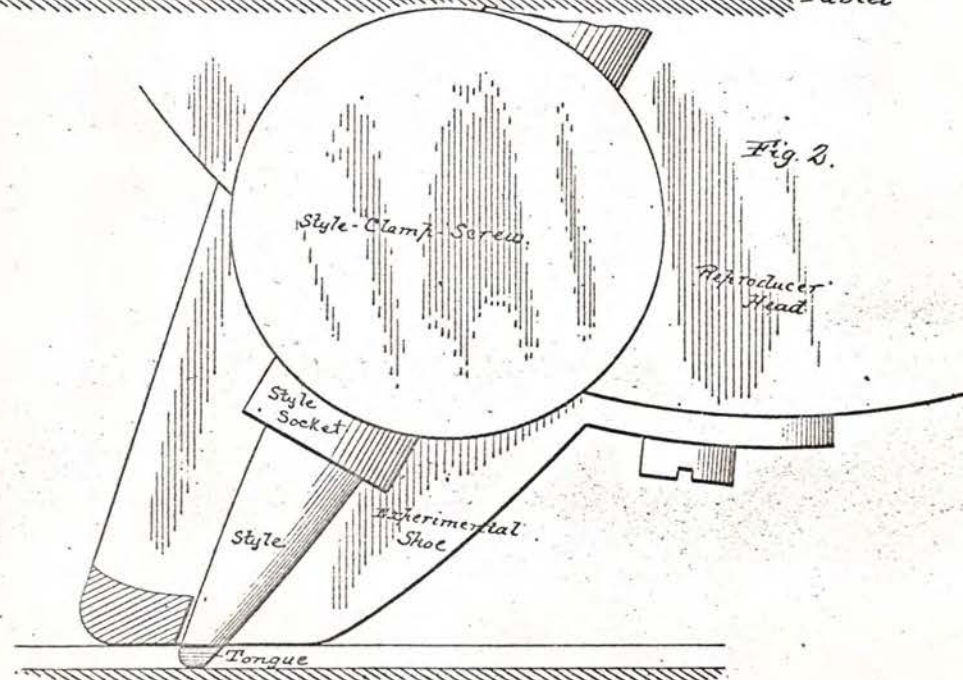
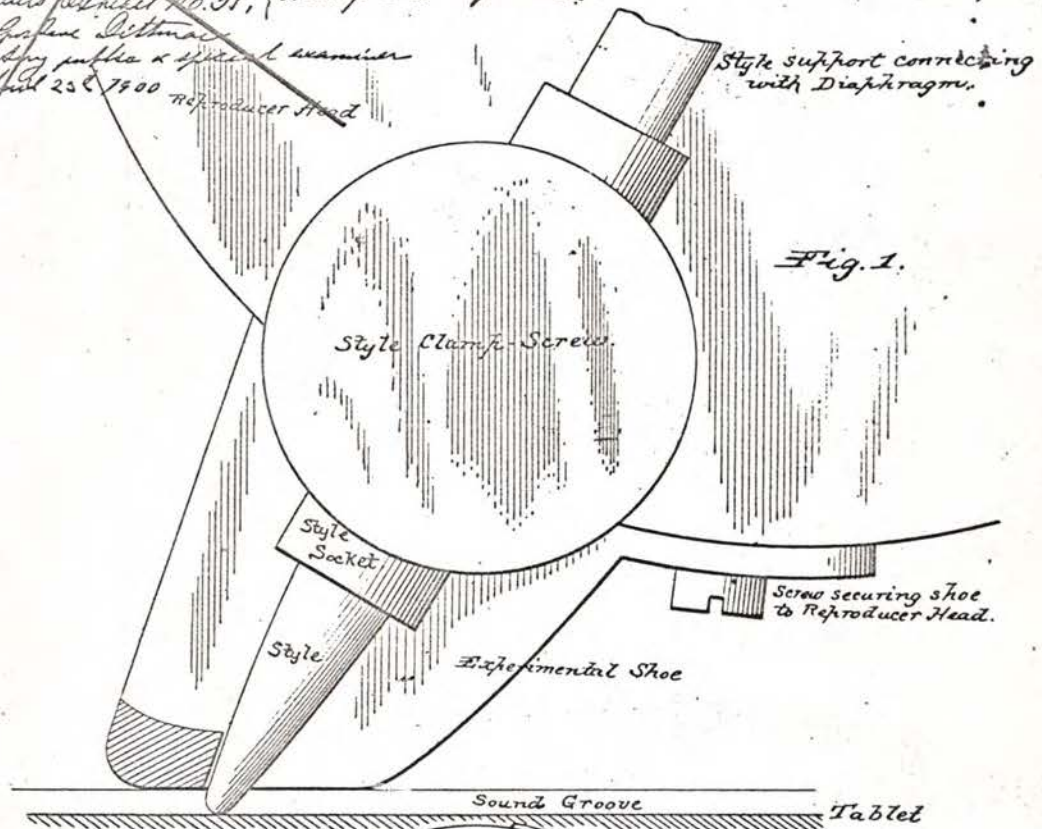
~~Drawing of Gramophone
Grooves of Style-Track.~~

~~including statement
noting public & special character~~

Am. Graph. Co. v Berliner Co. et al

Defendants Exhibit No. 31

In the U.S. Circuit Court
 in District of New York
 American Graphophone Co.,
 National Graphophone Co., } In Equity
 vs Frank Seaman
 Defendants Exhibit No. 31, { Drawing of Experimental
 Graphophone Reproducer. }
 before William
 Judge, Judge & Special Examiner
 April 25, 1890



U. S. L. E. R. A. P. A. Def't. Ex # 32
American Graphophone Co
Berliner Graphophone Co. et al.
Edison English Patent
#2909 of 1877.
 [Third Edition.]

James P. Lee
Att. Gen.



A.D. 1877 N^o 2909***.

Controlling by Sound the Transmission of Electric Currents and
 the Reproduction of Corresponding Sounds at a Distance.

THE UNITED TELEPHONE COMPANY'S DISCLAIMER AND
 MEMORANDUM OF ALTERATION.

[EDISON'S PATENT.]

Filed 17th August 1882.

TO ALL TO WHOM THESE PRESENTS SHALL COME WE THE UNITED
 TELEPHONE COMPANY LIMITED Send Greeting WHEREAS Her Most Excellent
 Majesty Queen Victoria by Her Royal Letters Patent under the Great Seal
 of Great Britain and Ireland bearing date at Westminster the Thirtieth day of
 5 July in the year of our Lord One thousand eight hundred and seventy seven in
 the Forty first year of Her reign did for herself her heirs and successors give and
 grant unto Thomas Alva Edison his executors administrators and assigns special
 license full power sole privilege and authority that he the said Thomas Alva
 Edison his executors administrators or assigns and every of them by himself and
 10 themselves or by his and their Deputy or Deputies Servants or Agents or such
 others as he his executors administrators or assigns should at any time agree with
 and no others from time to time and at all times thereafter during the term
 therein expressed should and lawfully might make use exercise and vend within
 the United Kingdom of Great Britain and Ireland the Channel Islands and Isle of
 15 Man an invention of IMPROVEMENTS IN INSTRUMENTS FOR CONTROLLING BY
 SOUND THE TRANSMISSION OF ELECTRIC CURRENTS AND THE REPRODUCTION OF
 CORRESPONDING SOUNDS AT A DISTANCE" for and during the term of
 Fourteen years thence next ensuing And whereas in pursuance and performance
 of a proviso in the said Letters Patent contained the said Thomas Alva Edison did
 20 within six calendar months next after the date of the said Letters Patent cause a
 Specification in writing under his hand and seal purporting to particularly describe
 the nature of the said Invention and in what manner the same was to be performed
 to be duly filed in the Great Seal Patent Office And whereas by Indenture bearing
 date the Second day of August One thousand eight hundred and seventy nine
 25 and made between the said Thomas Alva Edison of the one part and the Edison
 Telephone Company of London Limited of the other part the said Thomas Alva

[Price 8d.]

Edison's Impts. in Controlling by Sound the Transmission of Electric Currents, &c.

Edison assigned unto the said Company (*inter alia*) the said hereinbefore recited Letters Patent and all rights powers privileges advantages profits emoluments and benefits to the said Letters Patent appertaining or belonging. And whereas on the Thirteenth day of November One thousand eight hundred and seventy nine the said Edison Telephone Company of London Limited petitioned the Commissioners of Patents for leave to amend certain parts of the said Specification of the said Letters Patent which Petition was referred to Her Majesty's late Attorney General Sir John Holker and leave was given to the said Company to file in the Great Seal Patent Office a Disclaimer and Memorandum of Alteration as appears by the Fiat of the said Sir John Holker dated the Ninth day of February One thousand eight hundred and eighty and the said Disclaimer was duly filed in the Great Seal Patent Office on the Tenth day of February One thousand eight hundred and eighty. And whereas by Indenture bearing date the Twelfth day of July One thousand eight hundred and eighty and made between the said Edison Telephone Company of London Limited of the one part and us the United Telephone Company Limited of the other part and duly registered in the Great Seal Patent Office the said Edison Telephone Company of London Limited assigned to us the said Letters Patent and the rights and privileges thereby granted and the same thereby became and are now vested in us the said United Telephone Company Limited. And whereas on the Twenty fifth day of March One thousand eight hundred and eighty one we the said United Telephone Company limited petitioned the Commissioners of Patents for leave to further amend certain parts of the said Specification of the said Letters Patent which Petition was referred to Her Majesty's Attorney General and leave was given to use the said United Telephone Company Limited to file in the Great Seal Patent Office a further Disclaimer and Memorandum of alteration as appears by the Fiat of Her Majesty's Attorney General Sir Henry James dated the Fourth day of June One thousand eight hundred and eighty one and the said Disclaimer and Memorandum of Alteration was duly filed in the Great Seal Patent Office on the Thirteenth day of June One thousand eight hundred and eighty one. And whereas since the filing of the said last named Disclaimer and Memorandum of Alteration we the said United Telephone Company Limited have been in litigation with various persons and companies with respect to infringements of the said Letters Patent and we the said United Telephone Company Limited have found that the retention of Claims 1 and 3 of the said Specification as amended by the said hereinbefore recited Disclaimers having regard to the language of the Provisional Specification has given rise to questions as to how far such claims are valid as a matter of law upon the face of the Specifications. And whereas the subject matter of the said claims 1 and 3 is not of great commercial importance And we are therefore desirous of striking out the said Claims 1 and 3 and of confining the claim of the said Letters Patent to the second claim thereof NOW KNOW YE that we the United Telephone Company Limited by and with the leave of Her Majesty's Attorney General and for the reasons aforesaid do alter the Specification by striking out of the said Specification as amended by the said Disclaimer printed by the Queens Printers and published at the Patent Office in One thousand eight hundred and eighty one the first Claim comprising lines 39 and 40 on page 10. We also strike out the third Claim comprising lines 45 to 48 both inclusive on the said page 10. We also strike out the word "Second" at the commencement of line 41 on the said page 10. And in order that the effect of the said Disclaimer may be clearly understood we annex hereunto a copy of the said Specification as it will appear when so amended the Preamble and testing clause being omitted.

This Invention relates to that class of electrical instruments in which sound becomes one of the elements in the transmission of the communication and a corresponding sound is produced at the receiving station so that oral communications can be sent by electricity and clearly distinguished at the receiving station.

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Musical tones may also be sent but my present invention is especially available in transmitting and receiving oral communications

In transmitting musical tones the respective notes each have a definite period for each vibration hence there is a response at the receiving end from the notes that vibrate in time with the electric pulsations sent but in speaking there is little change in the musical tone but considerable in the modulations and inflections of the voice.

In my present Invention I make use of the vibrations given to a diaphragm or tympan by speaking into a resonant case to produce a rise and fall of electrical tension upon the line with such accuracy that the electric pulsations or waves will represent the atmospheric sound waves produced by articulation and an electro magnet at the receiving station will respond to the electric waves in such a manner as to reproduce the articulation by acting upon a resonant plate.

The transmitting instrument in a complete form is represented in section in Figure 1 and Figure 2 represents a receiving instrument which may be employed with it.

Referring to Figure 1 the resonant tube or box *a* is of a size and shape adapted to being spoken into the same having an opening at one end or side and a diaphragm or diaphragms *b* against which the sound waves from the human voice act and these and the motion that the diaphragm receives is the means of producing a rise and fall of electric tension on the line by the devices hereafter set forth so that the battery *B* connected to the line *l* will transmit a greater or less current to the distant electro magnet *m* Figure 2 and increase or lessen the magnetism of the cores and in so doing act upon a resonant plate *c* and develop sound corresponding to the articulation at the transmitting station.

The general features thus described pervade my entire Invention but in developing the same many useful and important modifications and variations have been made which I proceed to set forth.

For convenience the speaking instrument Figure 1 is provided with a handle *a'* and flexible conductors to the battery and line respectively so that it may be handled and brought to the mouth, and in like manner it is preferable to place the hearing instrument Figure 2 in a moveable handle *m'* so that it can be placed with the plate *c* against the ear this brings the sound close to the organs of hearing and the resonant plate touching the ear increases the distinction of the sound and prevents any false or prolonged vibrations of the plate.

In some of the modifications I have shewn the speaking instrument as a fixture and also the hearing instrument as a fixed resonant tube these being variable to suit the persons or the places.

The first especial feature that requires separate consideration is the peculiarity of the resonant tube for the voice I have experienced great difficulty in reproducing the sound of the hissing consonants such as *S* this appears to arise from the fact that this sound is deflected downwardly in leaving the mouth and does not act distinctly upon the diaphragm. By providing an edge in the resonant tube below the mouth upon which such consonant sounds are received the vibrations are given either to the resonant tube or deflected to the diaphragm. I find it preferable to employ a hole *e* at the lower part of the mouth piece against the edges of which the downward sound waves are directed. The same effect will be produced by a vibrating edge placed in the lower part of the mouth piece or the opening into the resonant box may be contracted to about half an inch in diameter to effect the same purpose. The next feature requiring consideration is the character of the diaphragm in the speaking instrument.

Many materials have been employed by me such as metals horn vellum celluloid ivory &c but almost all of these produce a prolonged or secondary vibration for their own resonant character hence the articulation is defective and the sound vibrations blend

After extensive experiments I find that mica is almost entirely free from any resonant action and hence it will respond with the greatest accuracy to the sound

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vibrations and being of a laminated character can be employed of any desired thickness and when secured at its edges responds with the greatest accuracy to the sound vibrations and does not require to be strained furthermore the changes of temperature and atmospheric condition have little or no effect upon the mica diaphragm or tympan.

I find that it is not practical to open and close the line circuits in instruments for transmitting the human voice the circuit to the line must be always closed and the transmission be produced by a rise and fall of electric tension resulting from more or less resistance in the line. This resistance may be produced in several ways I have shewn several which will hereafter be named but I find the most delicate to be small bunches or tufts or discs of some conducting elastic fibre such as particles of silk and an intermediate conducting or semi-conducting material this device I call an electric tension regulator it is more or less compressed according to the vibrations of the diaphragm or tympan and the electric current rises in tension as it is compressed or lessens as the fibre expands. This fibre is placed in a small roll *t* between the delicate diaphragm spring *u* Figure 9 and the variable presser *r* adjustable by screw or otherwise in the electric circuit at this point or it may be within a cavity in said presser *r* as in Figure 1 there being a delicate cork centre piece *w* to the diaphragm *b* with a piece of platina foil *x* in contact with the fibre. In all instances the telegraphic circuit at the diaphragm is made by a thin strip of platina or similar material extending to the centre from the line or battery connection.

The fibre is rendered semi conductive by being rubbed with plumbago soft metal or similar material or by a deposit of metal upon its surface or by fine ^{particles of conducting or semi-conducting material mixed with it, the conducting} power varying with the density of the tuft or branch of fibre.

The delicate spring *u* Figure 9 upon the mica diaphragm *b* is easily secured by solder passing into fine holes bored in the mica

In some cases I make use of a variable resistance resulting from greater or less intimacy of surface contact such as would result from a disk covered with plumbago placed adjacent to a diaphragm also covered with plumbago or other semi conducting material so that the proximity or extent of surface contact will produce rise and fall of tension the respective parts being in the telegraphic circuit.

I sometimes perforate the diaphragm 10 Figure 18 and place a strip of elastic material 40 across said diaphragm over the hole and upon this a piece of foil so that the same responds to very weak vibrations and in some instances two or more diaphragms are provided at different sides of the resonant box each with its own tension regulator the diaphragms being either the same or of different sizes characters or tensions so as to respond to varying sounds or acoustic condition the various tension regulators being all in the electric circuit this will produce greater rise and fall of tension for longer lines in consequence of the diaphragms acting simultaneously on the tension regulators.

In some instances it is preferable to make the mouth piece of the speaking instrument sufficiently large or flaring to receive all the sound vibrations whether coming from the mouth nose or throat

The tension regulator formed of fibre and conducting or semi conducting material may be either dry or moistened with a liquid.

In some instances I make use of the best quality of lamp black retained within a case to form the tension regulator the circuit passing through the same and the rise and fall of electric tension resulting from the compression of the same by the movement of the diaphragm.

I am enabled to record the sounds produced by the human voice or otherwise by causing the movements of the diaphragm to be registered on paper or soft sheet metal and then the paper may be used in an instrument to reproduce the sound upon a delicate diaphragm by giving to the same a vibration similar to that originally given by the voice.

h. Figure 4 is the indenting transmitter the diaphragm having a knife edge

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point *i* is the paper which has previously been passed through a machine to raise a V shaped rib 6. The movement of the diaphragm of *h* when the drum is in motion causes the knife edge point *P* to indent the raised rib to varying depths according to the amplitude of vibration of the diaphragm thus these indentations represent accurately all the tones and varying inflections of the human voice. The paper after being indented is passed through a second apparatus *n* Figure 5 almost similar to *h*. A spring 9 has a knife edge which rests upon the raised indented rib 6 the spring being connected to a delicate diaphragm 10 by a string or straw.

- 10 The indented rib reproduces in the spring 9 the movement of the indenting point and either by direct action or through the vibration of a string conveys the same motion to the diaphragm of *n* and reproduces previous sounds. If these sounds are to be transmitted over a telegraph line the diaphragm 10 see Figure 6 is provided with a cork disc *w* and fibrous tension regulator *t* before described to produce the rise and fall of electric tension on the line. The sound may be recorded in ink as represented in Figure 7. The diaphragm of *h* operates a very flexible self feeding pen *o* and causes the continuous line to be wide or narrow according to the amplitude of vibration of the diaphragm. The ink used should dry quickly and the strip may be passed at any time thereafter through the instrument shown in Figure 8 beneath the arm 12 having a point or points resting on the paper this arm is connected with a resonant diaphragm and the ink marks produce more or less friction according to the breadth and amount of ink deposited and this will set the diaphragm of *n* vibrating and reproduce the vibrations of the diaphragm of *h*.

- 25 An obvious modification would be to coat the paper with a substance which would cause considerable friction or even rough unsized paper might be used and a spring provided with a burnished point rather flat would cause the surface of the paper to be made smooth more or less according to the vibration of the diaphragm and the difference in the surface of the paper would produce a response of the

30 Receiving Diaphragm

I sometimes arrange the Battery in connection with the Transmitting Instrument as shewn in Figure 10.

- h* is the resonant chamber at the end of which is the diaphragm 10 and at each side of this diaphragm there are springs $c^2 c^3$ having points made of compressed plumbago mixed preferably with gum rubber but any substance not liable to rapid decomposition or the elastic or fibrous tension regulator aforesaid may be used. These points face each other on opposite sides of the diaphragm and make contact with platina foil discs secured to the diaphragm.

- The spring c^3 passes through a hole or small slot in the side of the chamber *h*: $d^2 d^3$ are the main batteries the battery d^2 has zinc to the line or spring c^2 and the battery d^3 has copper to the line or spring c^3 . When the springs c^2 and c^3 are adjusted to make contact with the diaphragm equally no current passes to the line but when the diaphragm is vibrated its movement to one side say c^2 causes a greater pressure upon the plumbago on that spring and a loosening of the pressure on the plumbago on c^3 hence the balance of the batteries c^2 and c^3 will be destroyed c^2 having the advantage will send a negative current to line upon the return of the diaphragm the battery currents will again neutralize each other. The vibration of the diaphragm to the other side causes the pressure to be reversed and the battery d^3 will send a positive current to the line.

- 50 As the tension regulator of fiber or of plumbago decreases and increases its resistance enormously under slight changes of pressure it follows that the strength of the electric waves will be in proportion as the speakers voice is strong or weak.

- In Figure 11 is shewn the contact spring which may be used adjacent to the diaphragm at one or both sides thereof c^3 is a U shaped spring secured to the screw e^4 which is adjusted back and forth by the thumb nut e^5 e^6 is the pillar holding such screw r is a piece of soft rubber or equivalent substance placed between the prongs of the spring c^3 e^7 is a wire or band which serves to bind the

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prongs tightly against the rubber r so as to prevent the prongs acting as a tuning fork and transmitting harmonic vibrations not desirable r^2 is the plumbago contact point. The object of the U spring and rubber is to present a semi rigid point for contact so as to prevent a rebound and allow of a slight yield when the plumbago is pressed by the diaphragm.

In Figure 3 the diaphragm of the receiving instrument is vibrated by a strip of paper chemically prepared that is in motion the pulsations of electricity passing over the line and producing more or less friction between the paper and an arm upon the diaphragm.

The resonant box or chamber n is provided with a diaphragm as aforesaid and to said diaphragm an arm h^2 is connected. At its outer end is an adjusting screw h^3 that presses upon a platina faced spring h^4 that is secured to this arm and said spring rests upon the strip of paper that passes over the drum h^5 .

The paper is moved slowly by rotating the drum h^5 and the waves of electricity coming over the line pass through the arm h^2 to the platina faced spring h^4 thence through the paper to the earth.

If a negative current passes in the opposite direction nearly all friction between the platina plate and the paper ceases and the diaphragm of the resonant box n retains its normal position.

When the positive current passes through the same channel the normal friction of the paper is augmented and the chemical surface acting upon the platina spring arm serves to give a forward movement to the diaphragm of the resonant box.

Thus the mechanical force applied to move the chemical paper or surface acts with the electric current to produce the vibration of the diaphragm of the resonant chamber and these vibrations will correspond to those of the diaphragm b made by speaking in the tube a .

The principle of this method of obtaining motion by electro chemical decomposition is that when a moving surface is in contact with a slightly yielding substance the tendency is to move the latter by and with the former. If the circumstances of contact are varied the adhesion of the surfaces will be sufficient to cause the moving surface to move the yielding substance or else to cause the yielding surface to slip more freely and by its spring go in the opposite direction to the moving surface.

The passage of electricity at the surfaces in contact will change the frictional adhesion make it more or less according to the substances employed. By balancing the mechanical forces so that when the surfaces in contact are not electrified the moving surface carries with it the yielding surface and when electrified the yielding surface slips back over the moving surface a mechanical movement is obtained that is dependent on the electrical condition of the surfaces in contact.

When it is requisite to obtain very perfect articulation and when loudness is not essential I adopt a modification shewn in Figure 12 of the device for compressing and expanding the tuft of conducting fiber which modification consists in placing between the diaphragm 10 and the fiber t a vibrating tongue 21 of steel permanently magnetised and arranging it to act in the same manner upon the tension regulator t as if it was the diaphragm. I replace the cork upon the diaphragm by a thin armature of iron 22 which is in close proximity to the magnetised tongue which tongue is secured at one end like an acoustic reed. In this position the diaphragm is free to move and at its approach to and recession from the magnetised tongue causes said tongue to follow its movements by magnetic attraction and thus the tongue is made to perform what the diaphragm previously performed in varying the tension of the electricity on the line.

A plate supported eccentrically and free at its edges when placed in the speaking tube responds advantageously to the tones of the voice. The circuit with this plate is completely through one or more tension regulators placed around its edges.

In practice I combine with the speaking or telephonic apparatus signal bells so

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arranged that when the telephone is not in use the line is thrown upon the bell by a switch which also acts as a call on the bell.

One feature about the bells is that the magnet which serves to actuate the bells is made of very high resistance using preferably German silver wire in the helix and thus serves to prevent a rapid consumption of battery power. A large number of telephonic wires may be worked from one battery if these bells are used.

The method I adopt for coating nonconducting substance with metallic substance is the reduction to the metallic state of metals from their salts by exposing them to the fumes which arise from the moist phosphide of a metal such as phosphide of Calcium or by placing the silk for instance in a sealed tube provided with metallic electrodes and volatilizing the electrodes by the passage of electric sparks such volatilized metals settle upon and coat the silk.

When great loudness is desirable as in Factories the tympan of the receiving instrument may be made to control an air valve of a reservoir in which air is stored under a regulated pressure.

The air allowed to escape will act with great power upon a local diaphragm. This diaphragm to obtain clear sounds requires a damper to check prolonged vibration. It must be damped by holding the fingers against it or by a tightly stretched cord rubbing against it or by a screw provided with a rubber tip held against it.

In some instances I make a record of the sound by the movements of the diaphragm using for that purpose a strip of paper moved along regularly between two rollers 25, 26 as in Figures 14 and 15 and there is a smooth thread or fine wire of soft metals 30 between the paper and the upper roller 25 and moving along with it. The diaphragm 10 of the resonant box is connected by a delicate rod 28 with this thread or wire as near to the bight of the roller as possible there being a fork or eye through which the thread passes hence deflections or bends are made in the thread or wire just before it is embedded into the paper by the pressure of the rollers. This may be used to reproduce the sound by vibrating a resonant diaphragm by the undulations of the groove made by the thread or cord.

By placing the fibrous tension regulator within a small band of India rubber the same is rendered more elastic and the fiber is allowed to expand by the heat of the current without altering the electric tension.

In some instances the diaphragm should be free to vibrate without being checked by contact with any stationary substance I provide for this by placing upon the diaphragm or tympan 10 Figure 17 a small cylinder t' of hard rubber or nonconducting material within which is the fibrous tension regulator t resting upon a platina foil connected to one pole of the battery and within this cylinder t' is a disc t'' of iron or other metal loose but pressed towards the tension regulator by a spring t^8 and screw cap t^9 and the other electric conductor is connected with said spring.

The inertia of the metal disc causes more or less compression of the tension regulator as the diaphragm is vibrated and hence the electric pulsations are sent over the line in harmony with the vibrations. Nearly the same effect is produced by connecting the disc t'' to a yielding spring t'' that extends across from one edge of the diaphragm to the other as seen in figure 16. This construction of tension regulating device is especially available with large diaphragms.

In some cases I use a soft rubber diaphragm immediately in contact with the transmitting or receiving diaphragm so as to check or dampen any prolonged or false vibration and render the sound more clear and free from prolonged tones.

In preparing the tension regulator I find in some cases that it is preferable to use lamp black mixed with pure plumbago amorphous phosphorous and a very small amount of nonconducting material such as rubber dissolved in a solvent that will entirely evaporate.

In figure 19 I have represented the circuit as passing through the diaphragm 10 tension regulator t and a Duluc's dry pile battery D P B to the earth. This

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battery is composed of about 300 pairs of paper discs coated with silver and black oxyd of manganese.

Figure 20 illustrates the device before mentioned for intensifying the sound 10 is the diaphragm vibrated by the sound 42 is a valve moved by such diaphragm 43 is a reservoir containing air under a given pressure *b* is the diaphragm against which the air allowed to escape by the valve acts and *t* is the tension regulator to transmit the electric pulsations or a hearing resonant case may be applied at the same place. 5

Figure 24 represents the diaphragm 10 tension regulator *t* with its adjusting screw and local circuit containing the battery *R* passing through a primary induction coil 49 and there is a key 50 in the same circuit. A secondary induction coil 51 is in the line circuit and is influenced electrically by the change of tension in the local circuit by the vibrations of the diaphragm 10. 10

The secondary coil is sometimes required with many layers of fine wire to set up a current of high tension to overcome the inductive effect from the line wires being adjacent to each other. I place the receiving instrument at the distant station between the induction coil and the earth as at *R* and use an electro-magnet *E M* with polarized armature to strike a bell this will respond when the key 50 in the local circuit at the distant station is opened and closed. 15

In figure 25 a similar induction coil 49 and local circuit is represented but the tension regulator is made of platina foil upon the surface of two soft rubber tubes one on the diaphragm the other on the adjusting screw. A shunt and rheostat at *R*¹ serves to prolong the magnetism in the induction coil and thus ensure a gradual rise and fall of electric tension in the line instead of a cessation of the same when the platina surfaces separate and at the receiving diaphragm *c* the rise and fall of electric tension in the line and its helix acts upon the permanent magnet to produce the vibrations of the diaphragm *c* and by connecting a shunt around the helix and placing therein the secondary battery *S. B* composed of metallic plates in acidulated water the action is rendered more uniform and the sound distinct. 20 25

When the diaphragm is arranged as in figure 26 to act upon a spring 56 through an intervening piece of soft rubber said spring 56 produces rise and fall of electric tension by employing a range of resistance 57 with spring tongues adjacent to 56. The greater amplitude of vibration of the diaphragm the more direct will be the electric circuit connections and the less resistance because the circuit will pass along the spring instead of going through all the resistance coils. 30 35

When several line wires run near each other the wire used for the acoustic or speaking telegraph is influenced by induction and false sounds will be produced. I counteract this tendency by placing one or more electro magnets 59 Figure 28 in the circuit of the speaking telegraph and one or more electro magnets 60 in the circuit of the adjacent wires and bringing the opposite cores of 60 at such a distance from the cores of 59 that a certain magnetic action will be set up in 59 by induction in the opposite direction to the induction currents from the adjacent line or lines. 40

By adjusting the distance between these magnets when the speaking telegraph is not in use until there is not any sound at the diaphragm from the induction currents then these currents will be neutralized whether strong or weak and will not produce any false sound when the speaking telegraph is in use. 45

I also employ double coils of wire for the same purpose one coil being in the acoustic wire and the other in the wire to be compensated. 50

A convenient form for the sound recorder or phonograph is to employ a cylinder 61 See figure 29 having a helical groove in its surface covered with tin foil and the Cylinder is revolved regularly by clock work and moved endwise by a screw on its shaft so that the indenting point *P* from the diaphragm 10 of *h* will be always in line with such groove hence the vibration of the diaphragm will be recorded by indenting the foil into the groove and hence the same sound will be reproduced by the point *P* of the hearing instrument *n* giving *a* the diaphragm 55

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of *n* the motions that result from the indentations of the foil moving in contact with such point.

The foil may be on a flat grooved plate and be indented and act as before named.

5 I would observe in conclusion that I do not claim generally the transmission and reproduction of sounds by increasing and decreasing the resistance of the circuit nor do I claim separately any of the parts or arrangements hereinbefore described and illustrated in the accompanying drawings except as hereinafter mentioned but I claim as my Invention:—

10 In an instrument for transmitting electric impulses by sound the combination with a diaphragm or tympan of electric tension regulators substantially as hereinbefore described for varying the resistance in a closed circuit substantially as set forth.

15 In witness whereof the United Telephone Company Limited have caused their Common Seal to be hereunto affixed the day of
One thousand eight hundred and eighty two.



JOSEPH B. MORGAN } Directors.
W. C. QUILTER. }
THOS BLAIRIE
Secy.

PATENT LAW AMENDMENT ACT, 1852.

In the matter of Letters Patent granted to THOMAS ALVA EDISON of Menlo Park in the State of New Jersey, United States of America. Dated 30th July 1877. No 2909.

25 To the Commissioners of Patents for Inventions

I hereby grant my Fiat giving leave to The United Telephone Company Limited, the Assignees of the said Letters Patent to file in the Office of the Commiss^{rs} of Patents for Inventions, with the Specification to which the same relates, the annexed Disclaimer and Memorandum of Alteration: but nevertheless upon
30 condition that no proceedings for infringement be taken against James Merrill Ormes, or Horace Hamline Eldred both of 31 Queen Victoria Street in the City of London, The London and Globe Telephone and Maintenance Company Limited, Mess^{rs}. Harrison Cox Walker and Company of Darlington in the County of Durham, Telegraph Engineers, John Tasker of Sheffield in the County of York
35 Electrician or William Johnson also of Sheffield in the County of York, Electrician, (hereinafter called the Opponents) or against any person or persons using any such instruments as are hereinafter referred to, that is to say, in respect of

1. Any Instruments made, or in course of manufacture on the 29th July 1882, by, or to the Order of, the said opponents or any or either of them.
- 40 2. Any instruments manufactured after the 29th July 1882 under or in pursuance of any contracts *bona fide* entered into previous to that date by the said Opponents or any or either of them for the supply of Instruments.
3. Any Instruments manufactured after the 29th July 1882 under or in pursuance of any contracts *bona fide* entered into prior to the 29th July 1882
45 with the said Opponents or any or either of them by any other person for the supply of such instruments to the said Opponents or any or either of them.

Edison's Impts. in Controlling by Sound the Transmission of Electric Currents, &c.

4. Particulars of all such Instruments as have been or shall be subsequently to the 2nd June 1882 manufactured or delivered, and of all contracts under which such last mentioned Instruments have been or shall be delivered to be furnished to the United Telephone Company Limited and verified by Statutory Declaration on or before the 14th September 1882. 5

5. All such Instruments as have not been delivered prior to 29th July 1882 to be numbered and marked with proper identifying marks before delivery, and an opportunity to be given to the United Telephone Company Limited or their Agents to verify the same.

6. Any question of *bona fides* to be referred to and determined by the Attorney General. 10

Dated this Sixteenth day of August 1882.

HENRY JAMES
Attorney General.

PATENT LAW AMENDMENT ACT 1852.

In the matter of Letters Patent granted to THOMAS ALVA EDISON of Menlo Park 15
in the State of New Jersey United States of America for the Invention of
"IMPROVEMENTS IN INSTRUMENTS FOR CONTROLLING BY SOUND THE TRANSMISSION OF ELECTRIC CURRENTS AND THE REPRODUCTION OF CORRESPONDING SOUNDS AT A DISTANCE" dated the 30th July 1877 No 2909.

And

20

In the matter of the application of The United Telephone Company Limited for leave to enter and file a Disclaimer and Memorandum of Alteration of certain parts of this specification of the said Letters Patent.

We The United Telephone Company Limited hereby accept and undertake to abide by the conditions imposed by the Attorney General and mentioned in the 25
Fiat hereunto annexed.

Dated this 15th day of August 1882.



JAMES BRAND
JOHN W BATTEN. } Directors.
THOS BLAIKIE
Secy.

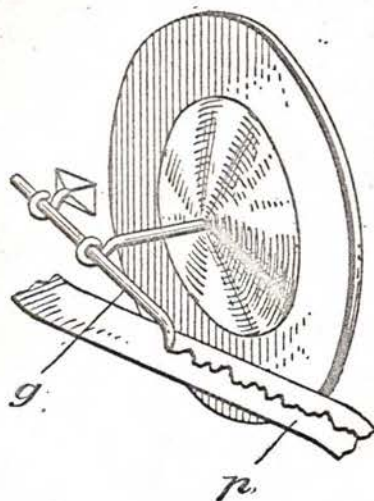
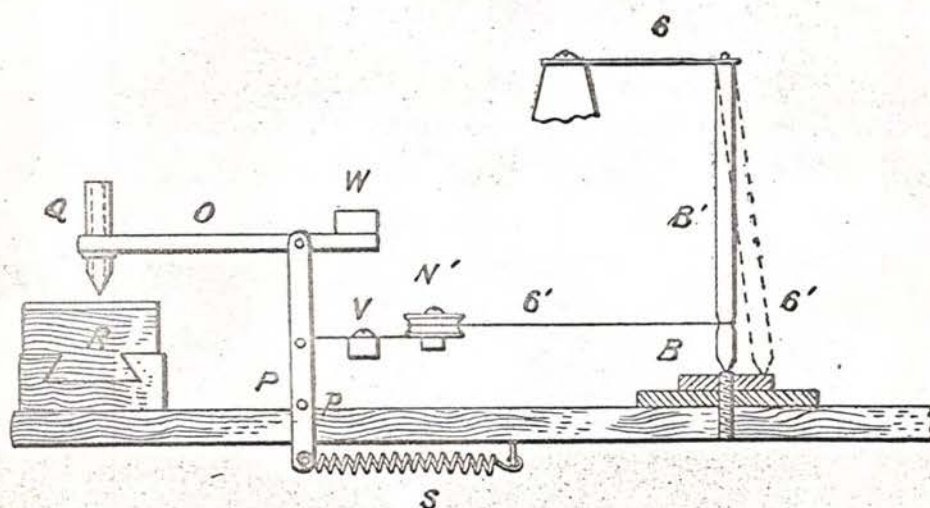
U. S. Cir. Court, East. Dist., of Pa.—Oct. Sess., 1898, No.

34. American Graph. Cō., vs. Berliner Gramophone Co., et al., Defendants' Exhibit, No. 33. Samuel Bell, Spec. Ex'r.

Extract from an Article entitled "The Examination of Vowel Sounds," by W. H. Preece and Augustus Stroh in the Synthetic Examination of vowel sounds, being a paper read before the Royal Society of London, England, and printed and published March 7, 1879 in "Engineering," (London, England, 1879). Vol. 27, pp. 200 to 202:

1. The authors of this paper have devoted much time during the past twelve months to a study of sonorous vibrations and the reproduction of speech. The invention of the phonograph has provided a great stimulus to this study. Many have worked in the same field, and many of the facts elicited by the authors have been anticipated by those who have been able to give more continuous study to the subject. Nevertheless, the mode of acquiring the apparatus employed and the results obtained are thought to be of sufficient novelty to justify their being brought before the Royal Society. * * *

3. The first object of the authors was to find a disc which would vibrate to the finest shades of sonorous vibrations, and which would be free from those characteristic and "personal" partials which are nearly inseparable from all vibrating discs, and which interfere with their true action. After innumerable experiments, on almost all known forms and substances, a stretched membrane of thin india-rubber rendered rigid by a cone of paper, was found to give the best effects. Such a disc was applied to the telephone and the phonograph with fair results, and the apparatus shown in Fig. 1 (see p. 200) was then constructed to record its vibrations. To the centre of the cone, a, b, shown in the prospective

2
Fig. 1.*Fig. 2.*

3

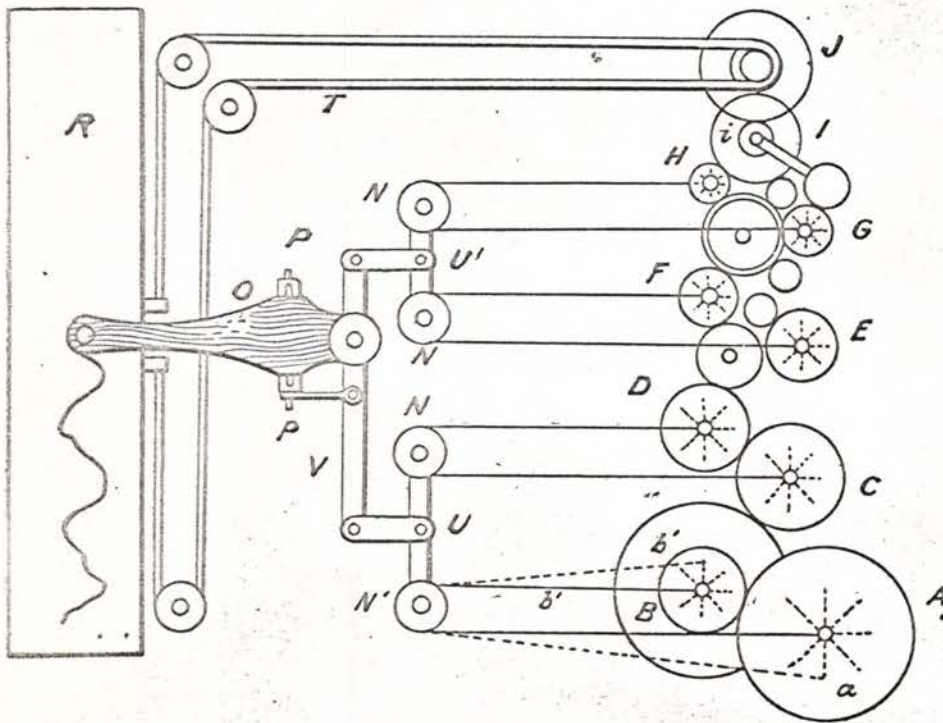
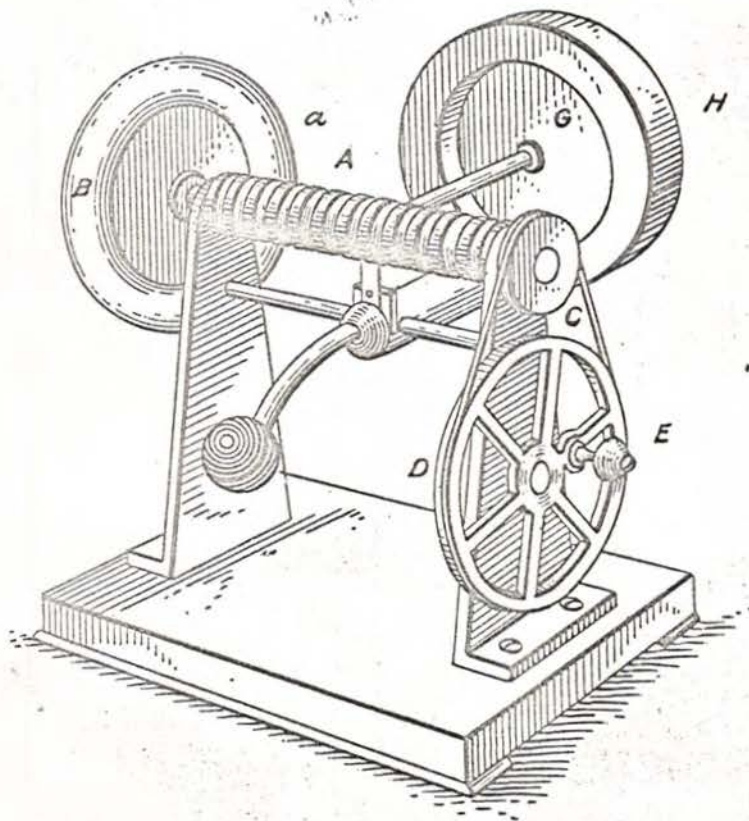
Fig. 3.

Fig. 9.

and section in Fig. 1, which was placed in a mouthpiece similar to that of a phonograph, was attached an extremely fine glass tube, *g*, which acted as a pen. The ink employed was aniline dye, and it was drawn through the pen by the very slight friction exerted between its point and the paper. The paper, *p*, on which the curves were to be drawn was the broad band frequently used for telegraphic purposes, and it was drawn under the pen by mechanism similar to that used in the Wheatstone automatic telegraph apparatus, at a speed which could be varied at will from 1 in. to 18 in. per second.

4. In this way curves were obtained illustrating the sonorous vibrations due to the tones of speech, but their form was not so perfect as could have been wished, due to the imperfections of the disc, as well as perhaps to the friction of the pen failing to indicate the high upper partials. Run at a slow speed, this instrument records the variations of air pressure in front of the lips; at a high speed it records both air pressure and sonorous vibrations. It thus combines the functions of Barlow's logograph and Leon Scott's phonautograph.

5. It is intended in this paper to confine our observations to those facts illustrating vowel sounds, a graphic representation of which, drawn by the new phonautograph is exhibited. * * *

11. In the following investigation, a method opposite to that of Messrs. Fleeming, Jenkin and Ewing was adopted, *i. e.*, the question has been attacked by the method of synthesis. It has been assumed that vowels are compounded of a prime sound and certain upper partials, and the number of these partials has, for convenience, been taken as eight, although there are many more. Indeed, we have taken in some cases the 10th, 12th, and 16th. Now, since each partial can be considered as a simple harmonic curve, if we assume the pitch of a prime to be constant, then it would be possible, by means of a

machine, to represent and vary each partial in phase and in amplitude. For this purpose an instrument was constructed, which we call "the synthetic curve machine" in which a number of toothed wheels, A, B, C, D, E, F, G, H, &c. (Figs. 2 and 3, p. 199) are mounted on steel pins or axes rigidly fixed on a board, so that they will revolve together and the numbers of their teeth are so calculated that during one revolution of the wheel A, B will make two; C three; D four; E five; F six; F seven, H eight revolutions, and so on. The wheel has on its prolonged axis a small crank, by means of which the whole system of wheels can be rotated. On the same axis is a pinion, I', gearing into the wheel, J, which, by means of a chain, T, gives motion to a sliding tablet, R. Each head of the pins on which the eight wheels revolve, has, in its centre, a small pit or hollow, in which rest the pointed ends of eight steel rods (one of which B¹ only is represented in Fig. 4), held in position by eight springs, b. To the rod on the wheel, A, is attached, near its point, one end of a silken thread, b', passing over the roller, N¹, the other end being attached to the rod on wheel B. The rods on the wheels C and D, E and F, G and H are similarly connected. The four rollers, N, are mounted on two levers, U and U', and these are connected by links to the lever V, which is finally linked to the lever P. This lever P, is pivoted at p, and by means of the spiral spring, S, keeps the levers, links, and silk thread in a state of tension. On the longer ends of the lever, P, is pivoted another lever, O, which carries at its shorter end a small counterbalancing weight, W, and at its longer end a glass pin, Q, containing suitable ink. On the table, R, is placed a piece of paper or smoked glass, which is held there by two spring clamps. Each of the eight wheels has on its face a number of small holes or pits, into which the points of the rods, B¹, can be placed, and these are arranged in eight rows, radiating from the centre. When one of the rods, for instance, that belonged to the wheel, B, is placed

in position, B^{11} , as indicated by the dotted lines, and motion is given to the wheels by means of the crank on the axle belonging to wheel, I, the crank-like movement of the rod, B^1 , will, by means of the silk thread b^1 , roller N^1 , leavers U, V and O, cause the pin, Q, to move to and fro with simple harmonic motion, while the table, R, will move longitudinally, the pin thereby writing on the paper a simple harmonic curve. This can be done with each of the eight rods separately, the result being in each case a simple curve. Should, however, two or more rods be placed on the faces of the wheels, the result will be a curve compounded of the sum of the several simple curves. In order to increase or decrease the amplitude of a curve, the steel rods are placed further from, or nearer to the centre of the wheels. Difference of phases is obtained by shifting the rods to the different rows of holes on the face of the wheels. Three additional wheels, K, L, M, have been fitted, making 10, 12, and 16 revolutions respectively, to one turn of the wheel, A, and the rods belonging to neighboring wheels are so arranged that they can be borrowed for the use of these smaller wheels, if desirable. * * *

18. In the hope of getting more perfect definition, another machine was now made upon which discs were fitted, whose peripheries were cut in exact copy of the curve produced by the synthetic curve machine. These curves were transmitted by vibration to the receiving diaphragm of a phonograph, really forming an "automatic phonograph." The automatic phonograph consists of an axle, A, Fig. 9 (see p. 202), about six inches long one end of which carries a fly wheel, B, and the other end a grooved pulley, C, round which a band or gut passes from a driving wheel, D, fitted with a crank handle, E. On rotating the driving wheel, the long axle is caused to make about three revolutions to one of the wheel.

On the long axle are placed, in such a manner that

they can easily be removed and replaced by others, a number of brass wheels or discs, a, a, a, a, the circumferences of which have been cut by a machine especially devised for that purpose, into different curves corresponding exactly to the curves obtained by the synthetic curve machine, but on a much reduced scale.

A diaphragm, G, with spring and frame, H, similar to that in a phonograph, is so fitted that it can be shifted from one disc to another, and the sounds produced by the different curves can be readily compared. The number of periods or resultant vibrations recurring on each wheel or disc has for convenience been taken at 30. Thus, when the driving wheel is rotated about twice per second, 180 to 200 vibrations are caused, resulting in a note at f or g in the musical scale.

A number of combinations of curves has been cut on the circumferences of the brass discs, representing each vowel sound with certain variations of the partials, as experience determined. These discs were then placed on the axle, and the sounds mostly resembling the vowel sounds of the human voice were easily recognized. * * *

19. In this way it was found that from about f to b in the musical scale, the sound oo consists mainly of the first partial or prime. But to maintain the oo character descending the scale, the second and third partials became slightly necessary.

At a Stated Term of the Circuit Court of
the United States for the Southern
District of New York, held in the
Court Room thereof in the Federal
Building in the Borough of Manhattan
and City of New York, this 9th day of
March, 1904.

PRESENT:

HON. F. HENRY LACOMBE,

U. S. CIRCUIT JUDGE.

AMERICAN GRAPHOPHONE COMPANY

vs.

In Equity.

NATIONAL GRAMOPHONE COMPANY
and FRANK SEAMAN.

No. 7063.

FINAL DECREE.

The cause coming on to be heard upon the pleadings and
proofs herein and upon the annexed consent of the solicitor
for the sole remaining defendant FRANK SEAMAN, and it being
represented to the Court that the Patent in suit has expired
and that the parties hereto have made a settlement for damages,
profits, and costs, and the Court being advised in the premis-
es, it is this day

ORDERED, ADJUDGED, and DECREED that the letters-patent
here in suit, No. 341,214, granted to C. A. Bell & S. Tainter
on May 4, 1886, are good and valid letters- patent and that
the complainant was at the date of filing of the bill of com-
plaint herein the sole and exclusive owner thereof; and that
the defendant has infringed the same by causing to be made and
by using and selling and causing to be used and sold certain
talking machines known as gramophones; and it is further

ORDERED, ADJUDGED, and DECREED, in view of the expiration
of the patent, that no injunction issue herein; and that an ac-
counting be waived, and each party to pay its own costs.

E. H. Lacombe

U. S. C. J.

We hereby consent to the filing of the foregoing decree.

Olivia H. Camp,
Sol. for Complt.
by Calomassie,
of Counsel.

Charles H. Malloy,
Sol. for Deft. Frank Seaman.

*Consent of
Frank Seaman*